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COAST WATCH

Here's looking at coastal Carolina

A fisherman ambled up to UNC Sea Grant Director B.J. Copeland at a meeting and said, "I've been hearing about this Sea Grant Program. Just what do you do?"

"Well, a lot of things," Copeland replied. "We research problems, hand out advice and write publications that can help people like you."

The fisherman thought for a moment. "Research?" he said. "What kind of research can help me?"

"Take farm drainage, for instance," Copeland said. "When farming increased in the Pamlico peninsula, fishermen perceived that their catches

were declining. The fishermen got mad at the farmers and farmers got mad at the fishermen. Both said they were just trying to make a living—put food on the table.

"We came up with a research program to find out what that relationship was really like."

Land drainage is just one of the problems Copeland and Sea Grant scientists tackle through research. Sea Grant researchers study shellfish contamination, seafood innovations, aquaculture, erosion . . . And when the results start coming in, it's up to the Marine Advisory Service and communications to get the word out.

This month *Coastwatch* will introduce you to Sea Grant and the problems we study. Inside are the research projects we are just beginning. In future issues we will report the results.



Photo by Gene Furr

A sea of sound research

Sea and sand

Erosion is one of coastal North Carolina's biggest problems, eating away at oceanfront properties and hampering development of residential, commercial and recreational areas. Little can be done to stop this gnawing problem, but knowledge of the process may aid in predicting rates of erosion and shoreline changes.

John Fisher, Margery Overton and Spencer Rogers are developing a model that will estimate erosion rates during storm periods. This year, they will build a test dune to monitor the erosion and wave and surge conditions. This data, along with information gathered from a wave tank, will be used to refine their model. With this, property owners, coastal managers and developers should benefit, as the long-term predictions outline suitable areas for construction.

Improved coastal management is the aim of another Sea Grant project. David Brower will continue a university program that studies legal and policy issues such as beach access, impacts of off-road vehicles, public trust rights and effects of the condominium boom on local government.

And since ocean policy graduate students do much of the research, the program trains tomorrow's managers.

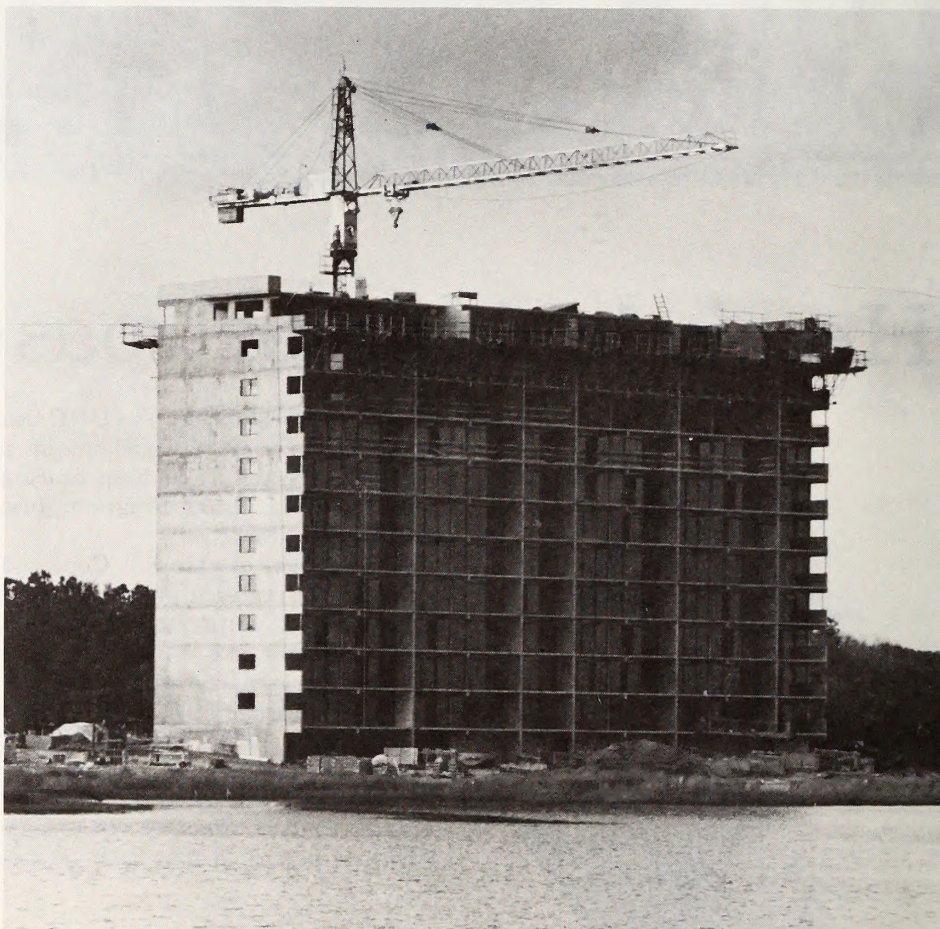
Research doesn't stop at the shoreline. Scott Snyder and Stan Riggs make their discoveries hundreds of feet below the ocean's surface. They seek out mesas rich in hardgrounds, phosphates and mineral deposits.

Hardgrounds attract great numbers of fish because they serve as attachment sites for food sources such as algae, sponges, coral and other organisms. To help commercial and recreational fishermen locate these prime fishing areas, Snyder and Riggs will map the hardground formations.

In addition, the escarpments contain potential mineral resources such as shell and quartz gravels, cobalt, nickel, platinum, gold and uranium.

Snyder and Riggs also will study

Photo by Nancy Davis



The condominium boom means added pressures on local government

the development and formation of phosphates. They want to learn the distribution of the sediments, which will help in classifying hardgrounds and determining their age and origin.

The researchers:

John Fisher, Department of Civil Engineering, North Carolina State University

Margery Overton, Department of Civil Engineering, North Carolina State University

Spencer Rogers, coastal engineering specialist, UNC Sea Grant College Program

David Brower, Center for Urban and Regional Studies, University of North Carolina at Chapel Hill

Scott Snyder, Department of Geology,

East Carolina University
Stan Riggs, Department of Geology,
East Carolina University

Minding the nursery

In eastern North Carolina, farmland is lowland. And that's a potential problem. To make the land fit for farming it must be drained of the water that accumulates there. And that's a problem too. Much of the freshwater drainage funnels into brackish estuaries where young fish grow. Resource managers and fishermen believe this outflow may be affecting fisheries production.

To alleviate this dilemma, Sea Grant is using science to find solutions that will allow the fisherman and the farmer to reap their harvests. Two Sea

Grant projects concentrate on the relationships between freshwater drainage and the estuaries. (The studies are coordinated with the state-funded Broad Creek Project, which is also focusing on freshwater drainage.)

In one study, Wayne Skaggs and Wendell Gilliam will examine the effect of land development, drainage methods, precipitation rates and soil properties on the rate and quality of water entering the estuary. Using this information, the team will develop a model that can predict how different drainage methods affect freshwater outflow. And researchers will be able to suggest which drainage methods lessen outflow rates.

In another study, Len Pietrafesa will finish his work on the processes affecting salinity changes in the estuary. Salinity changes can drive juvenile fish from the estuary (making them vulnerable to predation) or cause their death.

In examining the changes, Pietrafesa is studying how freshwater drainage and natural processes such as current directions, water speed and direction and temperature affect salinity. His results will be plugged into a model that can predict the effects of salinity changes on juvenile fish.

In other estuarine research, John Miller will examine the transportation patterns of juvenile fish across Pamlico Sound to estuarine nurseries. Miller wants to find out if juvenile fish "ride" wind-driven currents to their estuarine nurseries or swim to their destination. And he plans to determine the abundance of these baby fish and their ability to grow and survive.

The success of a productive estuary is dependent on the ability of the juvenile fish to survive. Larry Crowder will follow the interactions between young fish and their predators in Rose Bay. Crowder believes predation is a major factor determining survival and habitat choice of juvenile fish in the nursery areas.

The researchers:

J. Wendell Gilliam, Department of Soil Science, North Carolina State University

R. Wayne Skaggs, Department of Agricultural Engineering, North Carolina State University

Len Pietrafesa, Department of Marine, Earth and Atmospheric Sciences, North Carolina State University

John M. Miller, Department of Zoology, North Carolina State University

Larry B. Crowder, Department of Zoology, North Carolina State University

Downstream dilemma

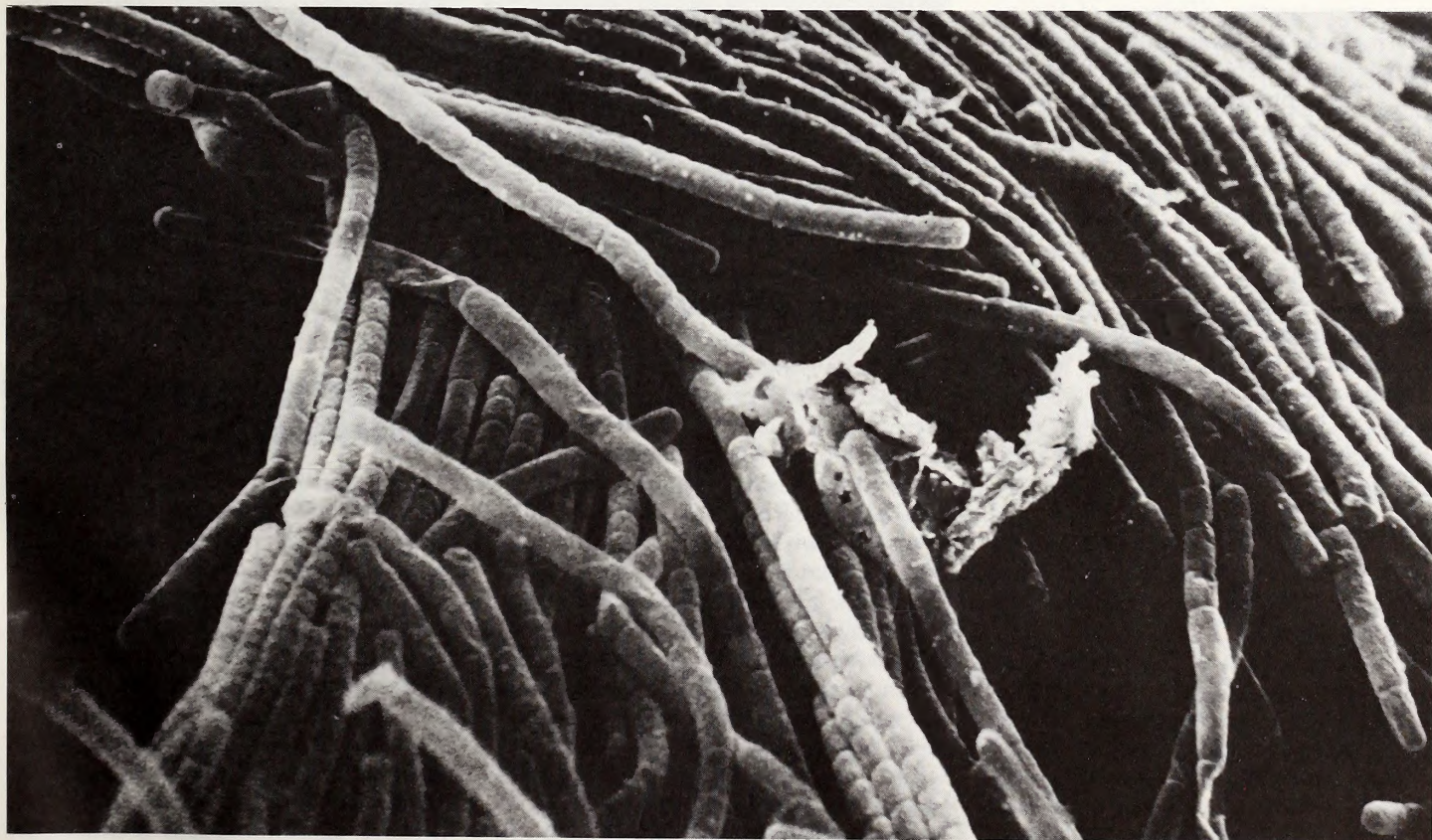
Upstream municipal wastewater treatment plants and industries pump effluent rich in nutrients into the Neuse River. Downstream the river blooms.

Upstream runoff from Durham, Raleigh, Wilson, Smithfield, Kinston and Goldsboro adds more nutrients to the Neuse. Downstream the river blooms.

Upstream farmers regularly dose their fields with inorganic fertilizers, which the rain washes into the river. Downstream the river blooms.

This upstream overload of nutrients such as nitrogen and phosphorus is nourishing massive blooms of blue-green algae downstream when conditions are favorable. The blooms form a malodorous scum that can do more than just hinder recreational activities.

Continued on next page



A form of blue-green algae found in the surface waters of the Neuse River

To determine how the Neuse River and blue-green algae respond to changes in nutrient levels, Don Stanley and Bob Christian will be studying the role of "new" nitrogen and recycled nitrogen in the blue-green algal blooms. New nitrogen originates from sources such as wastewater effluent and urban or agricultural runoff. Recycled nitrogen has been used by animals and organisms in the estuary and excreted as ammonia.

With information generated by this project, managers can determine what effects reduced nutrient inputs will have on the Neuse River and algal blooms. And they can incorporate this knowledge into the management plans proposed for the basin.

While Stanley and Christian focus on what causes blue-green algal blooms, Hans Paerl and Rolland Fulton will examine how the blooms affect the estuarine food chain. Evidence already gathered by Paerl indicated blue-green algae may be toxic or inedible to lower levels of the food chain—zooplankton. And lower level changes may affect organisms higher on the food chain—namely important commercial and recreational species of fish.

Paerl and Fulton believe the algae may decrease the efficiency of the estuarine food chain and alter the kinds of fish living at bloom sites. They will test these hypotheses in laboratory and field experiments.

In a laboratory at UNC-Wilmington, Ron Sizemore will employ biotechnology techniques to examine marine *vibrio*, a bacteria common to North Carolina's coastal waters. He will study bacteria taken from polluted and nonpolluted sites along the state's coastal waters. Sizemore may be able to use his techniques to "construct" a bacteria that will break down complex pollutant mixtures.

The researchers:

Don Stanley, Institute for Coastal and Marine Resources, East Carolina University

Bob Christian, Department of Biology, East Carolina University

Hans Paerl, Institute of Marine Sciences, University of North Carolina at Chapel Hill

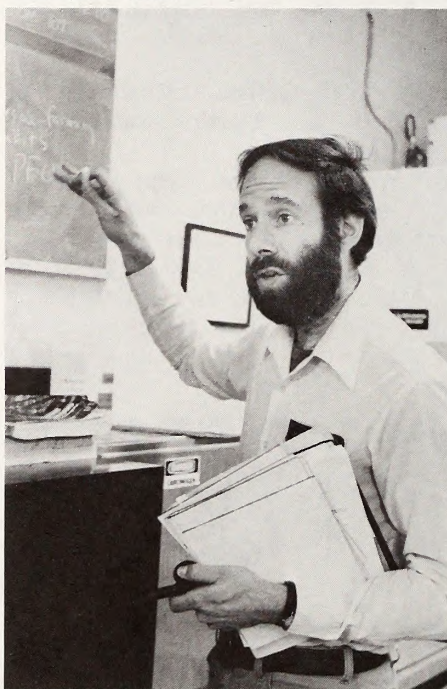
Rolland Fulton, Institute of Marine Sciences, University of North Carolina at Chapel Hill

Ron Sizemore, Department of Biological Sciences, University of North Carolina at Wilmington

Shelling out results

During the mid-1970s, North Carolina fishermen discovered a lode in the state's estuaries—hard clams. With northern clams frozen in their beds, southern mollusks brought prices that sent fishermen raking, tonging and dredging for the valuable nuggets. In Core Sound, fishermen forsook traditional harvest methods, turning instead to efficient mechanical harvesting methods. By 1981 hard clam catches had increased fivefold.

Photo by Neil Caudle



Mark Sobsey

Fishery managers worry the intense harvest is depleting hard clam stocks. The N. C. Division of Marine Fisheries already imposed some restrictions. But they may consider more.

Charles Peterson will supply managers with more facts about hard clams as he continues to research the mollusks. He will focus on the survival and growth of clam larvae in different habitats and test the hypothesis that removal of adult clams enhances larval survival. Similar tests will be conducted for bay scallop larvae.

To help clam gardeners (fishermen who raise clams on leased bottomland) with predation problems, Peterson will study two of the clam's greatest

enemies—blue crabs and snapping shrimp. Using field tests, Peterson will estimate the predators' abundance and appetite in areas suitable for clam gardening. And he will test methods for excluding the predators from gardens.

Overfishing isn't the only problem facing the clam fishery. Pollution also poses a hazard. Clams and their relatives, oysters, become contaminated when their habitat is polluted. Sewage treatment plants, faulty septic systems, land runoff and boats discharge waste that can carry enteric viruses and bacteria.

In his Chapel Hill laboratory, Mark Sobsey will continue to study one of the most serious viral contaminants—hepatitis A. Using sophisticated detection methods, Sobsey will study the occurrence of hepatitis A in field samples of shellfish, the relationship between bacteria levels and virus levels, the uptake and elimination of the virus, and its inactivation by heat.

Under controlled conditions, Sobsey will examine the elimination of hepatitis A and other viruses in depuration systems. In depuration plants, polluted shellfish are placed in tanks of clean water where they purge their contaminants. Sobsey will study the length of time and optimal conditions (water temperature, flow rate, density) for viral elimination in depuration systems.

The researchers:

Charles Peterson, Institute of Marine Sciences, University of North Carolina at Chapel Hill

Mark Sobsey, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

On the job

When it comes to supplying resource managers with answers, most research is aimed at understanding complex ecological and biological factors. But there's a people side of management. And understanding fishermen is just as important as understanding fish.

That's why Mike Orbach and Jeff Johnson are learning more about North Carolina fishermen who ply this state's waters and other states' too. North Carolinians are among the most mobile, aggressive fishermen on the East Coast, fisheries managers report.



A bounty of Florida scallops lured North Carolina fishermen south

And their mobility has implications for fisheries management plans inside and outside North Carolina.

Orbach and Johnson want to learn what factors influence the fishermen's movement and how their mobility affects the fishing industry and other businesses—processors, distributors and marine supply companies. And the team will examine management networks to see what consideration migratory fishermen are given when plans and policies are made.

With information from this project, fisheries managers can do a better job of assessing the impacts of management plans on all fishermen.

In another study, David Griffith will size up the labor needs of the state's seafood processing industry. The industry is labor intensive, and the work force is based on community and kinship ties. But the seafood processing industry is growing. Is there enough labor available for its expansion?

That's what Griffith wants to find out. He will work with the shellfish and finfish processing industries to determine how socioeconomic, demographic and social factors affect labor availability. By using this information, he can assess and predict the labor supply at various locations.

New industries can use Griffith's

results to choose locations for new plants; older plants can make better decisions about expansion. And management agencies can predict how policy decisions (catch limits or shortened seasons) in one sector of the fishery will affect other sectors (the processing labor force).

The researchers:

Mike Orbach, Department of Sociology, Anthropology and Economics, East Carolina University

Jeff Johnson, Institute for Coastal and Marine Resources, East Carolina University

David Griffith, Institute for Coastal and Marine Resources, East Carolina University

Catch of the day

North Carolina menhaden fishermen are worried about the future of their business. In 1983, they landed 177,973,000 pounds of menhaden for a dockside value of \$6,168,000—an average of about 3 cents per pound.

The statistics tell the story. While the menhaden fishery is the nation's largest in terms of volume, its value per pound ranks well below other species. The reasons are simple: the menhaden is an industrial fish. This oily fish has been used for fertilizer and for chicken feed, but it's never made it to the nation's dinner tables.

Sea Grant research may change that. In a previous study, Tyre Lanier, Donald Hamann and Frank Thomas showed that the menhaden could be transformed into surimi—a minced fish product developed by the Japanese. By water-washing the mince, they end up with a protein concentrate suitable for use in restructured seafood products such as shrimp, scallops and crab legs. The natural counterparts of these foods are high in demand and in price. But the restructured product is low in cost and high in food value.

The researchers found that a light, bland and excellent gel-forming surimi could be produced from menhaden. A mechanical deboner removes the bones, and the washing process eliminates all but 2 percent of the fat. Along with the fat goes the strong, fishy taste characteristic of menhaden. Since the surimi process uses only 20

Continued on next page

percent of the fish, the remainder can be processed for fish meal and fish oil.

Researchers will continue to refine the process used to make surimi out of menhaden. They'll also be examining the biophysical-biochemical basis for the extraordinary heat-gelation properties of fish muscle proteins.

To make surimi production more feasible, Allen Chao will try to minimize the amount of water necessary for surimi production. The conventional washing process requires a water volume 9 to 15 times the volume of the finished product, and it generates a large effluent treatment load. But a proposed counter-current process may reduce the water requirement by up to two-thirds.

The researchers:

Tyre Lanier, Department of Food Science, North Carolina State University

Donald Hamann, Department of Food Science, North Carolina State University

Frank Thomas, Department of Food Science, North Carolina State University

Allen Chao, Department of Civil Engineering, North Carolina State University

Taking stock

The striped bass is a prized commercial and recreational catch. But in recent years, the population of natural stocks declined dramatically. In 1974 commercial fishermen from North

Carolina to Maine caught 14.7 million pounds of striped bass. By 1980 the commercial catch totaled less than 5 million pounds. Sport fishermen reported similar catch declines.

Previously, Sea Grant researchers demonstrated the potential of a striped bass hybrid (striped bass x white bass) as an aquaculture candidate. The hybrid exhibited superior growth rates, improved survival, greater disease resistance and general hardiness and adaptability.

Now, researchers will tackle the task of turning that potential into reality. In an effort to launch aquaculture as a viable industry in the state, they'll combine research with demonstration.

Howard Kerby and Melvin Huish will work to improve the culture characteristics of hybrids through genetic manipulation.

Ronald Hodson, director of Sea Grant's aquaculture research, and marine advisory agent Randy Rouse will transfer that research to a demonstration project designed to work out the details of intensive culture and to transfer the results to industry.

The success of an aquaculture industry also will depend on a low-cost nutritional feed for the fish. Margie Gallagher will focus her efforts on finding the right food for the commercial culture of striped bass. She'll be evaluating various protein/energy ratios and the effects on growth, body

composition, metabolism and the digestion of protein.

An additional prerequisite to the development of a successful striped bass hybrid production facility is the control of disease problems. This is especially important in intensive aquaculture systems where disease problems are often magnified because of the close confinement of the fish. Aquaculturists estimate parasites cost them \$50 million annually. Ed Noga will develop culture methods for ectoparasites of fish in an effort to reduce disease problems.

The researchers:

Howard Kerby, Department of Zoology, North Carolina State University

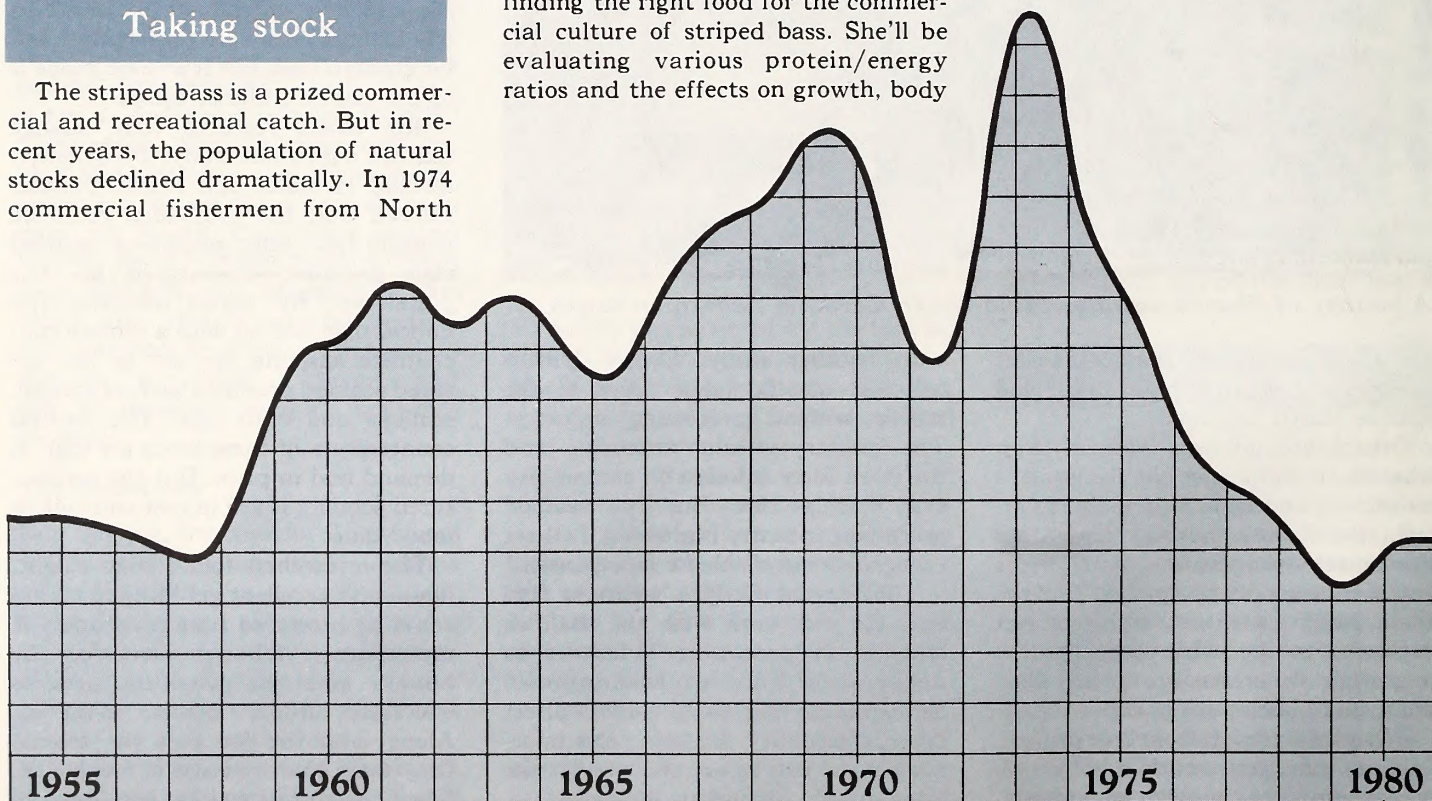
Melvin Huish, Department of Zoology, North Carolina State University

Ronald Hodson, Associate Director, UNC Sea Grant College Program

Randy Rouse, marine advisory agent, UNC Sea Grant College Program

Margie Gallagher, Institute for Coastal and Marine Resources, East Carolina University

Ed Noga, School of Veterinary Medicine, North Carolina State University



Commercial catches of striped bass have declined dramatically

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



North Carolinians are gaining a reputation for knowing how to shed crabs, and folks are asking us for advice. In February, a team of North Carolina experts will travel to Biloxi, Miss., to share some of its knowledge of the soft-shell delicacies with participants at the Inter-regional Soft Crab Symposium. Sponsored by the Mid-Atlantic and Southeast Marine Advisory Services, the symposium is designed to keep Sea Grant advisory agents up-to-date on the latest technology in crab shedding.

UNC Sea Grant marine advisory agent Wayne Wescott will describe the North Carolina soft crab industry, including peeler harvesting, economics and marketing, and facility design and water quality. Terry Sholar of the N.C. Division of Marine Fisheries will discuss the management problems associated with the soft crab industry. Sea Grant researcher Ronald Sizemore will explain the role of bacteria in soft crab mortalities.

European seafood lovers soon may be popping the top on a can of North Carolina squid. Sam Thomas, UNC Sea Grant's seafood specialist at the NCSU Seafood Laboratory in Morehead City, recently worked with a North Carolina processing firm interested in marketing squid abroad.

Thomas helped the company perfect its canning operation for squid. He recommended what percentage of

brine to use and ways to prevent moisture loss. Already, the company has processed 40,000 pounds of canned squid.



To many students, the ocean is a world of wonder ready to be explored. Often it's an appreciation they learn from teachers captivated by the sea. UNC Sea Grant recently recognized six such educators who displayed their knowledge and enthusiasm for the coast and its resources.

These North Carolina educators were selected this year on the basis of their involvement and leadership in marine education at school and in other settings. Each will receive a UNC Sea Grant College Program Marine Certificate as an award.

Recipients include: Hilda Bayliss, education coordinator for the N.C. Marine Resources Center in Manteo; Tom Bell, teacher and science chairperson at Lewis Chapel Junior High School in Fayetteville; Mark Joyner, aquarium specialist with the N.C. Office of Marine Affairs in Raleigh; Gerry Madrazo, science supervisor for Guilford County; Judith Spitsbergen, curator of education at the N.C. Maritime Museum in Beaufort; and Sally Zimmerman of Wilmington, former education specialist for the N.C. Marine Resources Center at Ft. Fisher.



Become submerged in the undersea world at the fifth annual SEAS (Southeastern Atlantic States) Diving Conference Festival Feb. 22 to 24 in Raleigh at the Radisson Hotel.

The event offers divers and underwater enthusiasts three days of films, demonstrations, socials and workshops. Programs this year include such topics as underwater photography, sharks, diving medicine

and underwater archaeology. Participants will also have the opportunity to put on a wet suit and tank and try diving pool-style. In addition, a trade show with about 40 exhibitors will be held at the Radisson.

Keynote speakers for the weekend are Stan Waterman, renowned underwater cinematographer, and Sylvia Earl, a popular marine scientist.

More than 500 people from 10 southern and southeastern states are expected to attend the conference. The public is invited to all events, and there are registration fees.

The conference is co-sponsored by the N.C. Marine Education and Resources Foundation, UNC Sea Grant, the N.C. Wreck Divers Association and the N.C. Office of Marine Affairs. For more information, write Doug Young, SEAS '85, P.O. Box 31186, Raleigh, N.C. 27622. Or call 919/733-2290.



The Crystal Coast Civic Center in Morehead City is going to look like a gigantic boat dock March 15 to 17. That's when the fifth annual North Carolina Commercial Fishing Show will display commercial fishing boats and gear for fishermen and the public to view.

Dealers and manufacturers will show the latest in fishing boats, nets, motors, traps, pots, engines and accessory gear. And seminars will be offered during the three-day event on such topics as fiberglass repairs, basic engine maintenance, marine fisheries policies and seafood preparation.

For merchants interested in participating, space inside the civic center can be rented for \$50. To exhibit boats, merchants must pay a fee of \$1.50 per foot for their first and largest boat and \$1 per foot for each additional one. Participants are also asked to complete an entry form, available from Bob Hines, UNC Sea Grant marine advisory agent in Bogue Banks.

Continued on next page

The show, which is free, is sponsored by UNC Sea Grant, N.C. Division of Marine Fisheries and the N.C. Agricultural Extension Service. Hours are 6 p.m. to 9 p.m. Friday, 10 a.m. to 5 p.m. Saturday and 11 a.m. to 5 p.m. Sunday. For more information, write Hines at the Marine Resources Center in Bogue Banks, P.O. Box 896, Atlantic Beach, N.C. 28512. Or call 919/247-4007.

With an increasing demand from pharmaceutical, cosmetic and food processing industries for substances found in seaweed, researchers are looking for cost-efficient ways to harvest natural populations of seaweed.

In a UNC Sea Grant mini-grant, Donald Kapraun and Frederick Zechman, of the Department of Biological Sciences at the University of North Carolina at Wilmington, will test a seaweed culture system. The researchers will set up a small demonstration system to determine monthly growth rates of the seaweed and to estimate production costs for such an investment. Kapraun and Zechman hope to answer the question: How much does it cost to grow seaweed in North Carolina?

Spencer Rogers, UNC Sea Grant's coastal engineer, and Alan Stutts of the University of Nevada at Las Vegas have been awarded mini-grant funds to study factors influencing the decision to locate permanent structures in ocean hazard areas of coastal North Carolina.

In a recent analysis of oceanfront development in North Carolina, Rogers found that about 50 percent of the permanent structures permitted for ocean hazard areas might be seaward of the vegetation line in 35 years or less. Rogers and Stutts want to determine how perceived risk influences decisions to build or purchase a building in an ocean hazard area. With their results, the investigators may be able to suggest ways public policymakers can influence the decision-making process of property owners planning to build in a hazard area.



The Mid-Atlantic Fisheries Development Foundation awarded two grants to Frank Thomas, director of Sea Grant's work at the NCSU Seafood Laboratory in Morehead City, and to Joyce Taylor, Sea Grant's seafood agent at the lab.

In a grant to increase seafood utilization, Thomas and Taylor will conduct workshops for economics extension agents and food professionals. Their programs will include dressing, handling, transporting, preserving and preparing the seafood catch.

Another grant will allow Thomas and Taylor to prepare seafood consumer information for the visually impaired. Seafood has traditionally been neglected from the menus of the visually impaired, but Thomas and

Taylor hope to change that. They'll prepare large print and cassette tape educational materials explaining the selection, care, handling and nutrition of seafoods, as well as some recipes for use by totally blind or visually impaired people.

Coastal Capers, written by Lundie Spence, UNC Sea Grant's marine education specialist, and Vivian Barbee Coxe, is a marine education primer designed to provide elementary grade teachers with activities or "capers" that introduce the marine environment. The primer also may be used by teachers with remedial or special education students, or by 4-H and scout leaders. The 20 capers are designed to motivate students to learn basic skills in science, math, language arts, social studies and art.

To order the illustrated primer, write UNC Sea Grant. Ask for UNC-SG-84-05. The cost is \$3.50.

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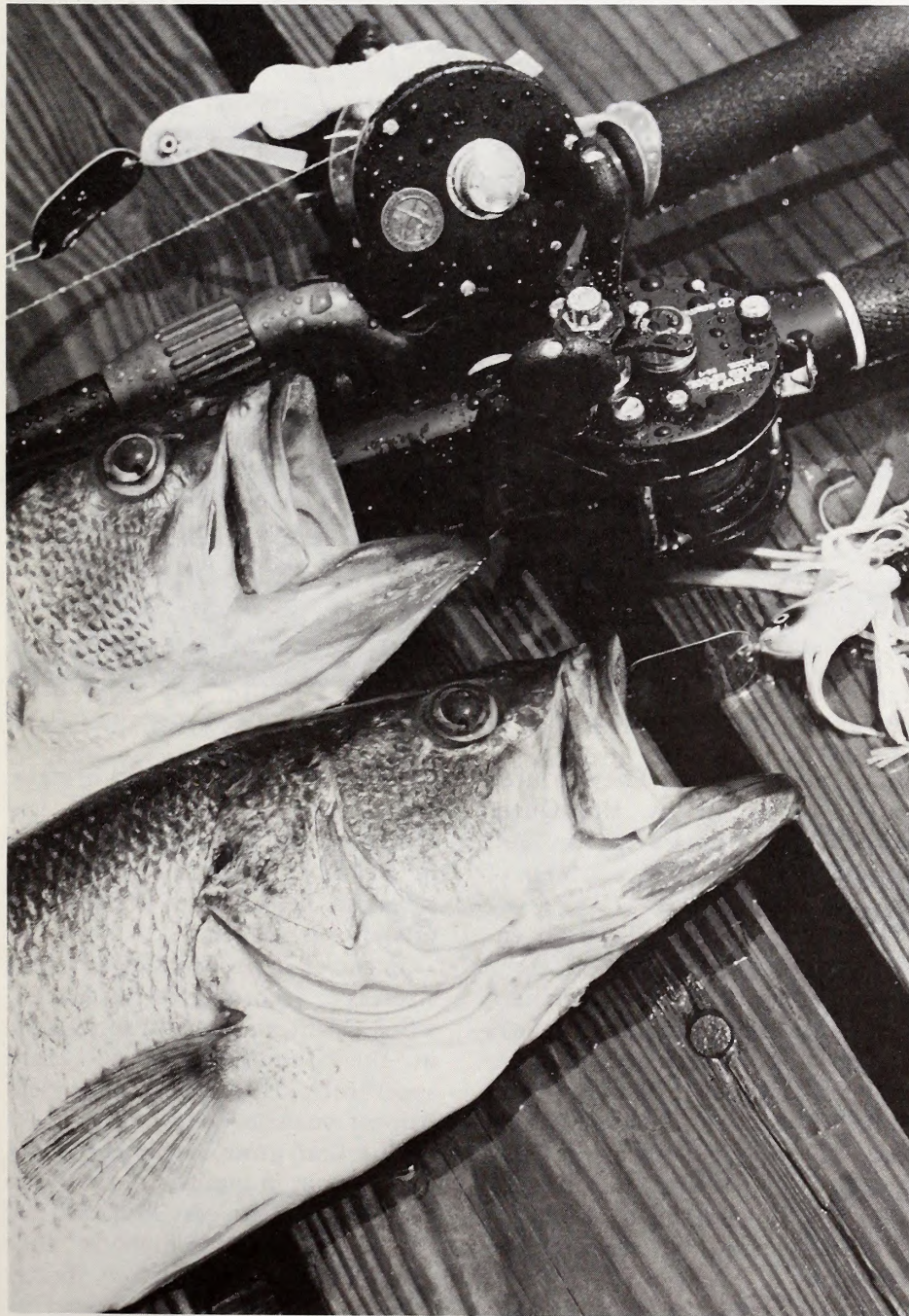
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COASTWATCH

Photo by Joel Arrington



Whirly birds took these largemouth bass from Currituck Sound

Gone Fishing

Anglers — not an easy group to characterize. They're the fishermen who drop a line from a bridge for tonight's dinner. They're the sportsmen who pay hundreds of dollars for a chance to fight a marlin. They're the anglers who seek the competition and big purse of tournaments.

Although a varied lot, their goal is always the fish at the end of the line. And the lure of that fish brings millions of dollars into the state's economy. It also unites fishermen to take a stand for recreational interests — ample stocks, habitat preservation and saltwater access.

This month *Coastwatch* will examine the impact of sport fishing on the state's economy and the political pressure anglers are exerting on management boards. Next month, we will focus on how recreational fishing can remain a viable sport for the future.

Buoys, bait, boats—big business

To most people, big business in North Carolina means textiles, tobacco and three-piece suits. But to others, it's fishing poles and waders that are making the economy's wallet bulge. The state reeled in about \$193 million from recreational fishing in 1980, says the U.S. Department of Interior. And few doubt the sport will prosper in the years to come.

Thousands of anglers travel to the Carolina coast each year to take advantage of the huge inventory of fish. They come equipped with boats and tackle, but often need food, fuel, other supplies and a place to stay. The spending quickly adds up for towns like Manteo and Hatteras and keeps North Carolina one of the nation's leading saltwater fishing states.

Despite the widespread economic impact of recreational fishing, statistics on saltwater anglers in North Carolina are sparse. The diversity and mobility make it difficult to compile reliable data.

Most of what we know comes from experts in the business. Research provides the rest. Such information would benefit the fisheries, new businesses and coastal management, says UNC Sea Grant researcher Jeff Johnson, an anthropologist at East Carolina University. Knowing how anglers spend their money could give merchants an idea of what to stock. And knowledge of incomes may help the policymaker decide if a proposed saltwater fishing license is affordable.

One widely known fact is that North Carolina shares its waters with fishermen from all directions. The majority of them are North Carolinians, but others come from Virginia, Florida, Ohio, Pennsylvania, Maryland and other Eastern states.

The reasons they fish here are many, says Joel Arrington, outdoor editor of the N.C. Division of



Photo by Joel Arrington

Charter boats add thousands of dollars to the state's economy

Travel and Tourism. They're lured here year-round by the Outer Banks, the closeness to the Gulf Stream and an extensive system of estuaries and sounds.

Just as the state's location entices fishermen from different areas, it attracts both Northern and Southern species of fish, says Arrington. In the winter, saltwater anglers put out their hooks and lines for striped bass and gray trout. During the summer, they fish for larger species like tarpon, pompano and Spanish mackerel. Flounder, perch and bass are popular game in the sounds.

To catch these fish, most fishermen in the state use small boats or

fish from banks, piers and bridges, says Charles Manooch of the National Marine Fisheries Service in Beaufort. But the big money rides on the waves of the wealthy offshore fishermen.

It comes in on boats of different sizes, too, according to Jim Bahen, a Sea Grant marine advisory agent in the Wilmington area. More specifically, three types of anglers fish off our coast, he says.

The first group owns the boats you gawk at in marinas — the 30- to 60-foot ones that cost from \$30,000 to \$1 million. "Somebody that could afford a boat such as that is in his late 30s or 40s, has a good income and is established," says

Bahen. He or she probably makes \$80,000 or more a year.

A second group includes the young executives whose annual salaries range between \$50,000 and \$90,000. They frequently fish in tournaments, as many are geared specifically to them.

Families with smaller boats make up the third category of sport fishermen. With salaries of \$25,000 to \$40,000, they use their boats to travel to the Outer Banks or teach the kids to ski, Bahen says. And when there's the chance, the fishermen in the family puts out a net or line.

The inshore fisherman has different characteristics, says Johnson. During a two-year study, he compiled information on fishermen from six regions of North Carolina's sounds. His work examines bank fishermen, who fish from banks, piers and bridges, and boat fishermen.

The typical sound fishermen are white males in their early 40s who have enjoyed recreational fishing for over half of their lives. Each year, they spend an average of 40 days on the water, waiting for croaker, trout, bass, or any other edible species to bite their bait.

Of the two types of sound fishermen, those who fished from boats were most like offshore anglers. They were more educated, worked in white-collar jobs and had higher

incomes. On fishing trips, boat parties of two or three people spent an average of \$212 in 1982, while bank fishermen averaged \$238. Most of their expenses were for lodging, food, fuel, bait and tackle and boat maintenance.

Other than expenditures for goods and services on a fishing trip, tournaments and charter boats are big moneymakers for the state. In the off-season, billfish and mackerel tournaments attract hundreds of saltwater sport fishermen anxious to hook the biggest fish or catch one of the prizes.

Tournaments "have a great economic impact in a limited area for a short period of time," says Arrington. Some effects are documented in a 1979 survey of 1,060 saltwater tournament fishermen by Sea Grant researchers Leon Abbas and Peter Fricke. They found that fishing parties spent an average of \$978 for each tournament entered. This included all expenses but entry fees. They also noted that the average fisherman was 42 years old, had a college education and made about \$70,000 a year.

Rich Novak, a Sea Grant marine recreation specialist, recently completed another study of participants in a drum tournament in Hatteras last fall. From a sample of returned surveys, he found that most of the money spent by fisher-

men was for lodging, meals, groceries, gas and beverages. Since the event was on the Outer Banks, the men and women tended to stay in the area for a few extra days, and brought along a few friends.

North Carolina's economy also benefits from the use of 100 or more charter boats or headboats. For \$300 to \$550, six people can hire a large fishing vessel for day or half-day trips. But this pleasure may be on the decline, says Bahen. Many of the charter boats are staying closer inshore to save on fuel costs.

When gas is expensive, the big ticket items like charter boats do feel a pinch, says Arrington. But he feels the greater affect is on tourism. "The fishing's not cut back, but travel is. People don't travel as far to fish."

So if you want to go offshore and don't mind fishing with a few more folks, you can take your tackle aboard a headboat. They take about 100 people, and it costs about \$30 to \$45 a day, says Bahen.

Although the price of saltwater fishing is rising, merchants and businesses associated with the industry need not worry. Sport fishermen will keep casting their lines as long as there are fish to catch. And that's good news for North Carolina's economy.

—Sarah Friday

Photo by Steve Murray



The promise of tranquility and fish lure many anglers to North Carolina waters

Hooked on fishing

Sherry Banner says her husband, John, isn't a typical recreational fisherman — he's a fanatic. John admits that, weather permitting, he spends almost every weekend fishing 20 to 30 miles off Wrightsville Beach or Southport.

He primarily slow trolls with bait for king mackerel. But he also "plugs" (casts with artificial bait) for speckled trout in the fall and winter.

John says he has always been interested in recreational fishing — saltwater and freshwater. But his family's move to Wilmington five years ago turned him from an occasional fisherman to a hardcore angler. He admits to already clocking 400 hours on the 22-foot Mako he bought last April.

What draws John to bait a hook and cast a line? He enjoys matching wits with fighting game fish and the taste of freshly caught fish hot out of the oven.

But he stresses that fishing for the Banners "is a family affair." Sherry and son, Jay, often accompany John on his offshore trips. "It has really given me a lot of one-on-one time with my son," John says. "And Jay's become such a good fisherman that he's almost to the point where he's teaching me."

And a good offshore angler is one with experience to his credit, sturdy tackle in his hand and good equipment on his console, John says. John's boat, Whiskey-Jack, is equipped with a VHF radio, LORAN-C and a chart recorder.

"I rely on electronic equipment quite heavily," he says. "It helps you to find underwater structures, ledges or wrecks where game fish congregate, and it allows you to go back to those same spots time and time again."

But electronic equipment, a good boat and sturdy tackle can amount to a hefty bill for the offshore fisherman. John estimates that a boat like his, light tackle (20-pound class) and a few electronics could easily cost a

Photo by Jim Bahen



Jay and John Banner

recreational fisherman \$20,000 to \$22,000.

And then there's the matter of gasoline and oil for each trip. John uses about 60 gallons of gasoline per trip, costing him from \$65 to \$85. But John often pays for his gasoline by selling his catch to local fish dealers. (Recreational fishermen must buy a license to sell their catch.) And he catches his own bait with a 12-foot cast net.

Each year John puts his fishing skills to the test during five to six king mackerel tournaments. "I enjoy the competition, the friends you make and the chance to make some pretty good money." (Tournaments award cash prizes for the largest catches, and a participant jackpot, called the Calcutta, is divided among the winners.)

Although John is an avid angler, he also is concerned about conservation. He feels that many stocks are overfished commercially and recreationally. "I think it is time that we had more controls — net sizes, catch quotas, licenses — on recreational and commercial fishing. There's got to be some compromises on both sides."

John favors a saltwater fishing license if the money from the license is funneled back into the recreational fishery through better regulations, more enforcement and development of artificial reefs. "A saltwater license would show just how many saltwater fishermen there are out there," he says. "I think people will be surprised at that number."

John believes most recreational fishermen favor a license. A license would offer anglers an opportunity to provide input into regulations that are inevitable, he says. "With increased catches and better equipment and boats, it's hard for a fish to find a place to hide," he says. "That's why I think we have got to have better conservation."

—Kathy Hart

Casting for political clout

It used to be that a fishing club was a social club. Members gathered to talk tackle, rods and reels and to swap tall tales of fish caught — or almost caught.

Today's recreational fisherman is a different breed. He's more likely to talk of coastal habitat, nursery areas, and access to salt water. He wants tighter regulations on some species. He wants a bigger say in policymaking decisions.

In the political arena, anglers are demanding attention. Little wonder folks are beginning to listen. Estimates of the number of saltwater sport fishermen in the state range from 350,000 to 800,000. Whichever figure you choose, the numbers add up to clout. (See story, p. 2 for the economic value of the sportfishing industry.)

To add strength to their numbers, sport fishermen are banding together. They've found that even though they're a diverse lot, they have common causes.

In 1983, with the help of Sea Grant marine recreation specialist Leon Abbas, the N.C. Saltwater Fishing Federation formed. Comprised of club and individual memberships totaling over 1,400 anglers, the federation is "a voice for the recreational fisherman in North Carolina," says Bob Stryker, federation president. Through the federation, recreational fishermen are raising a unified voice.

Frequently anglers' interests are at odds with those of commercial fishermen. Often they fish for the same species, but their motivations differ. Anglers claim commercial fishermen are overfishing stocks. The latter protest they are only earning a living, that recreational fishermen fish for sport instead of income.

Recreational fishermen claim the commercial fishermen have had the advantage of representation on policymaking boards such as the N.C. Marine Fisheries Commission. People like Stryker would like to see more of their own on the commission, representing



"I think the marine fisheries division is beginning to realize that the recreational fisherman is a viable, active source of political pressure."

—Bob Stryker

the recreational interests.

"Historically the recreational fishery has never been recognized as an economic factor," says Stryker. But as recreational fishermen pump more dollars into the state's economy, that excuse has faltered.

"I think the marine fisheries division is beginning to realize that the recreational fisherman is a viable, active source of political pressure," he says.

N.C. Division of Marine Fisheries Director Bob Mahood says, "We've had an ongoing recreational program. The artificial reef program has been the main thrust of our efforts. . . . But everything we've learned about finfish pertains to the recreational as well as the commercial catch."

In the past, lack of money has been the biggest limiting factor for recreational fishery programs. But recent legislation expanding the Dingell-Johnson Act may change that. Enacted in 1950, the bill allocated the

proceeds of a 10 percent federal excise tax on certain items of fishing tackle for state fisheries agencies. The funds have been available to freshwater fisheries for years and have been used by the N.C. Wildlife Resources Commission for projects such as inland boat ramps.

The latest bill expands the excise tax to include additional taxes on fishing equipment and makes funds available specifically for saltwater projects. In March, the division will hold a series of public hearings to find out how anglers want the money to be spent. The meetings will be held on the coast as well as in some inland cities since that's where most of the recreational fishermen live. (For a list of dates and locations, see the "Back Page" section of *Coastwatch*.)

Mahood estimates the tax could generate \$100 million of new money nationwide. For North Carolina, the bill could mean as much as \$200,000 to

Continued on next page

"Everything we've learned about finfish pertains to the recreational as well as commercial catch."

—Bob Mahood

\$450,000 for saltwater projects.

Mahood says the first priority for the new funds will be a study to find out how many recreational fishermen there are, how much money they spend and how they impact the fisheries.

Stryker says the federation is in favor of a saltwater fishing license. The only recreational fishing license now issued by the state is administered by the N.C. Wildlife Resources Commission, which handles items relating to freshwater fishing. In the Southeast, Louisiana, Texas and Alabama require saltwater fishing licenses. In addition to generating more money, a saltwater license would give managers a more accurate idea of the number of saltwater fishermen in the state.

Although the nonprofit Saltwater Fishing Federation is prohibited from lobbying, Stryker says members are encouraged to exert political pressure individually. At the top of the anglers' list of grievances is the state's handling of declining catches of striped bass. A prized recreational catch, the striped bass is known as a good fighter and even better table fare. But it's also been an important commercial species.

The N.C. Marine Fisheries Commission set a 12-inch total length limit for striped bass in internal coastal waters and a 24-inch minimum in the Atlantic Ocean. In 1984, the commission set a closed season on striped bass from June to September.

But recreational fishermen say the commission didn't go far enough. In other states, concern over the declining populations has led to outright bans on striped bass fishing.

By June 1985, the state must comply with the Atlantic States Marine Fisheries Commission's management plan for striped bass or the federal government could institute a moratorium on striped bass fishing. The plan calls for closure of spawning grounds to striped bass fishing, a 14-inch minimum size limit in internal waters, a 24-inch limit offshore, and a 55 percent reduction in landings over

what would have been achieved had the state instituted the measures in 1982.

Recreational fishermen favor the plan set by the Atlantic States Marine Fisheries Commission. Stryker says the federation would like to see North Carolina enforce strict regulations on the striped bass. Commercial fishermen, on the other hand, say further regulations would threaten their livelihoods.

Stryker downplays any animosity between recreational and commercial fishermen. After all, he says, their ultimate goal should be the same. "In the federation, we've tried to make it known that we're looking for an improvement on the resource and we're not out to hassle the commercial fishermen. Anything we can do to improve the resource has got to benefit all of us," says Stryker.

—Nancy Davis



Photo by Joel Arrington

Anglers hope stricter regulations will revive the striped bass fishery

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



For teachers who want to add a tropical note to their classroom lessons, Lundie Spence has a workshop for you. Spence, UNC Sea Grant's marine education specialist, is organizing a nine-day teachers' workshop in Mayaguez, Puerto Rico, July 14 to July 22. The workshop is designed for sixth, seventh and eighth grade teachers and supervisors.

It will provide educators with environmental teaching skills for classroom and field-oriented activities. They will explore coral reefs, mangrove swamps and rain forests. And the investigative skills they learn can be applied to the temperate North Carolina coast.

The workshop also provides an opportunity for cultural and educational exchange between North Carolina and Puerto Rican educators. This will be a bilingual program, but knowledge of Spanish is not necessary.

The cost of the workshop is \$360, which includes housing and a subsistence allowance. The plane fare from Raleigh to Mayaguez is about \$600. Participants will be responsible for obtaining their own tickets.

The workshop is limited to 15 participants, and applicants will be accepted on a first-come basis. A \$100 deposit, due by May 1, will secure a spot.

Teachers and supervisors can receive continuing education credits

from North Carolina State University, gifted and talented credit, and possibly two graduate credits in education. For more information or an application form, write Spence at UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605 or call 919/737-2454.



UNC Sea Grant is offering a marine policy fellowship for graduate study leading to a master's degree in the Department of Sociology, Anthropology and Economics at East Carolina University. The fellowship, which is administered through the ECU Institute for Coastal and Marine Resources, provides a student with a \$6,000 stipend, full tuition and fees (including out-of-state tuition), and funds for supplies, travel and other research expenses. The graduate student will work with Michael Orbach, a maritime anthropologist in the department, on marine policy issues.

Applicants should submit complete transcripts, graduate record examination scores, a statement of interest and at least three references to Orbach at the Institute for Coastal and Marine Resources, East Carolina University, Greenville, N.C. 27834. For more information, call Orbach at 919/757-6883 or 757-6779. Applications should be submitted by April 15.



Almost every day a fisherman calls Sea Grant agent Wayne Wescott to ask about shedding crabs. How do I know when a crab will "bust?" Should I use a flow-through or closed recirculating system to shed crabs? How should I market my crabs? How much profit can I expect?

To help crabbers answer these questions, Wescott is planning a soft-crab workshop March 2 from 10 a.m. to

4:30 p.m. at the Beaufort County Community College in Washington. Experienced shedders will be on hand to tell other fishermen about their successful shedding methods. The workshop will include discussions on blue crab biology, peeler identification, harvesting methods, facility design and marketing.

And this year, experts will discuss shedding crabs in well-water, temperature-controlled recirculating systems. Crabbers in areas plagued with poor water quality or sand and silt problems can use well water to shed crabs. And crab mortalities in these systems are as low or lower than systems that use brackish water.

The fee for the workshop is \$5 in advance or \$6 at the door. For more information about the workshop or to register, write Wayne Wescott, UNC Sea Grant, Marine Resources Center/Roanoke Island, P.O. Box 699, Manteo, N.C. 27954 or call 919/473-3937. Make checks payable to UNC Sea Grant.



Sea Grant researcher Mike Orbach, a maritime anthropologist at East Carolina University, will again offer a course on marine policy at the Duke University Marine Laboratory from July 15 to August 16.

The course introduces students and professionals to marine policy and policymaking. The history of marine organizations, legislation and issues will be traced, and their effects on local, regional, national and international arenas will be explored.

Students taking the course may receive credit from either the University of North Carolina at Chapel Hill or Duke University. The deadline for preregistration is April 15, but students may enroll until the first day of class.

For more information about the course, write Orbach at the Depart-

Continued on next page

ment of Sociology, Anthropology and Economics, East Carolina University, Greenville, N.C. 27834 or call 919/757-6883. For registration information, call the UNC Institute of Marine Sciences at 919/726-6841 or the Duke University Marine Laboratory at 919/728-2111.

UNC Sea Grant was awarded \$1,210,000 in federal funds for 1985 by the National Sea Grant College Program, which is part of the National Oceanic and Atmospheric Administration. This will be the first year of an approved three-year grant cycle. The program will receive an additional \$605,000 in state matching funds through the N.C. Office of Marine Affairs.

To focus scientific attention on the possibilities of marine biotechnology, UNC Sea Grant, the North Carolina Biotechnology Center, the University of North Carolina at Chapel Hill Program in Molecular Biology and the UNC-Chapel Hill Marine Science Program will sponsor a conference March 24 to 26 at the Quail Roost Conference Center.

Conference participants will identify prospects for specific, scientific applications of biotechnology to marine phenomena. For more information about the event, write conference organizer Dirk Frankenberg at the Marine Science Curriculum, 12-5 Venable Hall 045-A, UNC-Chapel Hill, Chapel Hill, N.C. 27514 or call 919/962-1252.



The Use of a Flat-Plate Current Meter in Nearshore Flows, by D.K. Hollingsworth and F.Y. Sorrell of the NCSU Department of Mechanical and

Aerospace Engineering and T.B. Curtin of the NCSU Department of Marine, Earth and Atmospheric Sciences, describes how a flat-plate current meter can be used to measure currents in nearshore waters. Measuring currents by conventional oceanographic techniques is difficult and often inaccurate. This new device will make accurate measurements more easily obtainable. And the measurement of water velocity and temperature in nearshore areas can provide information useful for proper management.

For a copy of this paper, write UNC Sea Grant. Ask for UNC-SG-WP-84-5. The cost is \$2.25.

Research for Managing the Nation's Estuaries: Proceedings of a Conference in Raleigh, North Carolina includes the challenges, papers and discussion presented at the first National Estuarine Symposium last year. The 420-page book was edited by UNC Sea Grant Director B.J. Copeland and the Sea Grant communications staff — Kathy Hart, Nancy Davis and Sarah Friday. For a copy of the book, write UNC Sea Grant. Ask for publication UNC-SG-84-08. The cost is \$8.

The N.C. Division of Marine Fisheries will hold a series of public meetings to find out how recreational fishermen want additional Dingell-Johnson funds to be spent (See story, p. 5). The meetings will be held at 7:30 p.m. at the following locations: March 6, Kermit E. White Continuing Education Building, Elizabeth City State University, Elizabeth City; March 7, Willis Building Auditorium, East Carolina University, Greenville; March 12, Holiday Inn North, Winston-Salem; March 13, Room 119 in the new court facilities of the Cumberland County Courthouse, Fayetteville; and March 14, Room 302, New Hanover County Courthouse, Wilmington.

For more information, contact the Division of Marine Fisheries at 1-800-682-2632.

A reminder: The North Carolina Commercial Fishing Show will be held March 15 to 17 at the Crystal Coast Civic Center in Morehead City.

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COASTWATCH

Photo by Steve Murray



Researchers are studying ways to enhance recreational fishing

Fishing for ways to improve catches

Although anglers have no trouble catching king mackerel and spotted trout today, tomorrow may be a different story. Populations of some species are declining, and increased numbers of recreational and commercial fishermen are putting more pressure on favored stocks.

To vent the pressure, researchers are introducing the angler to unfamiliar and misunderstood species—puffer, stingray, shark and sea catfish. Many sportsmen shun these species, unaware of their food value or fighting qualities. Armed with accurate information, researchers can dispel

myths and convince the angler to sample thick shark fillets or the white, flaky meat of triggerfish.

To enhance the habitat of favored and underutilized species, state and local governments and private organizations are footing the bill for construction of artificial reefs. Made of old tires, scrap concrete and sunken ships, the reefs turn unproductive ocean floor into protective havens for fish and prized fishing holes for anglers.

This month, *Coastwatch* will focus on new ways to enhance the recreational fishery.

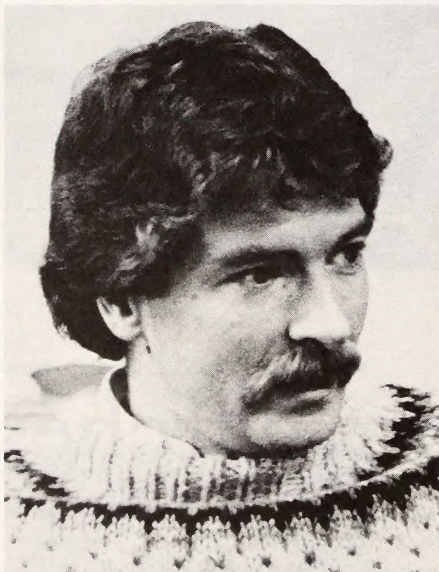
Looks aren't everything

Shunned fish shake poor image

A sport fisherman casts a line over an old wreck off Wrightsville Beach. Instead of reeling in the red snapper he hoped to lure, he finds an amberjack at the end of the line. Remembering that he heard somewhere these fish have worms, he throws the fish aside to die.

This scenario is repeated frequently throughout North Carolina's coastal waters and those of the Southeast. As anglers pursue snappers, groupers, king mackerel and spotted trout, they cast aside their incidental catch—the sea catfish, puffers, sharks, sea robins and stingrays.

But the species that sportsmen throw away today may be tomorrow's prized catch. At least that's what Jim Murray and Jeff Johnson are planning. In the first part of a National Marine Fisheries Service project, Murray and Johnson studied why anglers prefer some species of fish over others. They surveyed fishermen from North Carolina, Florida and Texas to find the answers.



Jim Murray

"Basically, we learned that any fish that doesn't look like a fish isn't used by recreational fishermen," says Johnson, a Sea Grant researcher and an anthropologist at East Carolina

University. "Fish with feelers, spines or skin instead of scales were perceived as ugly. Many fishermen equated ugliness with being poisonous or dangerous. And that meant these fish weren't utilized."

The team found that most anglers prefer species that have white, flaky meat and are easy to catch, clean, store and eat. Sport fishermen did include several dark meat species on their preferred lists—bluefish, mackerel and mullet. And some fish are sought because of the challenging fight they offer when hooked.

The researchers also found that preferences varied from region to region, says Murray, director of UNC Sea Grant's Marine Advisory Service. North Carolina sportsmen valued smaller species—croaker, spot and perch—more highly than fishermen in Florida or Texas.

Johnson says this occurred because of the lack of access to larger species (usually found offshore 40 to 50 miles in the Gulf Stream) and because of North Carolina's extensive sound system. Anglers here fish inshore waters more than Florida or Texas fishermen.

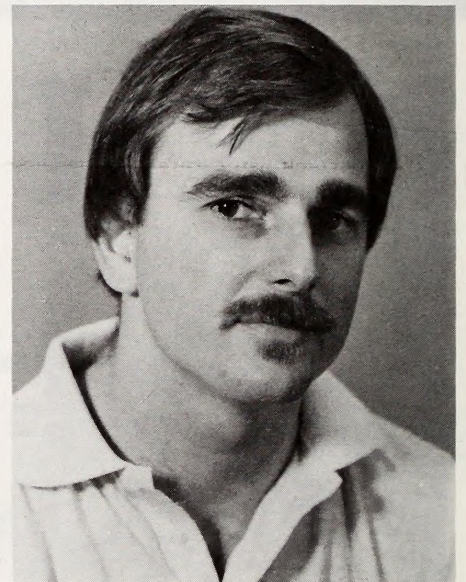
But recreational fishermen reject fish they perceive as ugly, difficult to clean, dangerous to handle and poisonous, or fish with dark meat. More often than not, this rejection is based on hearsay and rumor, rather than actual experience with these species, says Johnson. And, he says, the rumors are often misleading or incorrect.

For example, sea robins often are perceived as poisonous by sportsmen because they are ugly. But in Europe the sea robin is called grondin — an ingredient in classic French bouillabaisse.

When anglers aren't discarding species because of misconceptions, they cite the ready availability of better species as the reason for neglecting less-favored fish. But these preferred fish may not always be abundant.

"Many of the popular recreational species—flounder, grouper, red drum—are becoming overfished," says

Murray. "The size of some fish populations are down, and the number of fish caught per fisherman is down because so many people are fishing. We need to spread out the species we're targeting."



Jeff Johnson

A number of these underutilized species are good to eat and fun to catch. They're just non-traditional."

Getting recreational fishermen to target underutilized species is one reason why NMFS funded Murray and Johnson's project. NMFS has been encouraging commercial fishermen to net underutilized species for years. But until now, no effort has been directed at recreational fishermen, who number over five million individuals in the Gulf and South Atlantic. NMFS statisticians estimate anglers reel in 30 to 35 percent of the total finfish poundage harvested for food in the United States.

By encouraging recreational fishermen to catch underutilized species, resource managers are hoping to lessen the demand for and conflict over traditional species sought by commercial and recreational fishermen. And if anglers begin to favor shark or amberjack, consumer demand for commercial quantities may not be far behind.

In the second part of Murray and

Johnson's study, the team will develop educational materials about underutilized species. The materials—brochures, a cookbook and slide shows—will dispel misconceptions and teach anglers how to clean, prepare and cook these neglected species.

Johnson says education will be the key to getting recreational fishermen to target underutilized species. "Often we found that people didn't deal with these fish because they didn't know anything about them," he says. Education can help here. And since many of the misconceptions about underutilized species are based on hearsay rather than experience, education can go a long way to alleviate those problems, too.

"Amberjack isn't targeted because fishermen say they have worms, and they sometimes do. But lots of preferred fishes have worms. You can cut them out." When amberjack is fried the day it's caught, it tastes like grouper—a highly sought fish.

Amberjack is gaining acceptance in West Florida, where it is served in a few restaurants. And information about the species' thick fillets and white, firm meat may gain amberjack a place on more sportsmen's plates.

But amberjack isn't the only shunned fish to share common charac-

teristics with valued species. Johnson says many non-traditional fish share good and bad qualities with their favored cousins. In Texas, redfish, a prized fish, shares almost every positive and negative trait with the ignored black drum and sheepshead. In North Carolina, small, overlooked species such as pinfish and pigfish are very similar to sought-after croaker and spot.

Likewise, Johnson says a fisherman's rejection of a species often is based on one or two negative aspects. Frequently underutilized species possess as many, or more, positive characteristics. For example, shark takes extra preparation time, but its meat yields thick fillets that have few bones. And the darker meat of tuna and bonito make them excellent fish for chowders and smoking.

Murray and Johnson plan to stress these common characteristics and positive qualities as they urge anglers to target spurned species. They plan to:

- develop six to eight brochures describing how to clean and prepare non-traditional species.

- encourage fishing tournament organizers to add underutilized species to their prize lists. The Scotts Hill King Mackerel Tournament is plan-

ning to offer prizes for amberjack this year.

- organize an underutilized species cookbook for anglers.

- provide training programs for Sea Grant marine advisory agents in the Southeast.

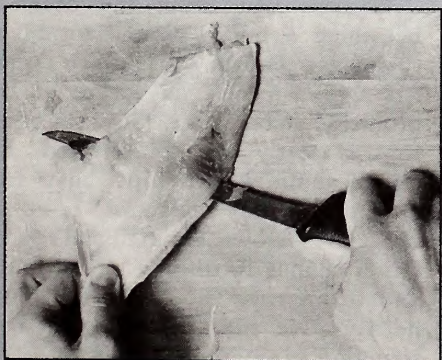
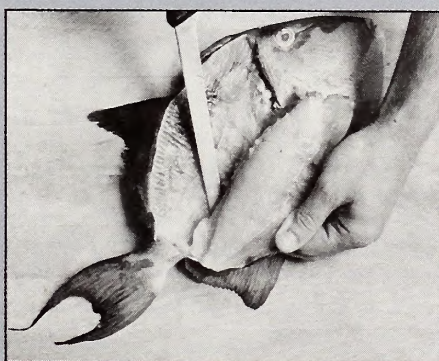
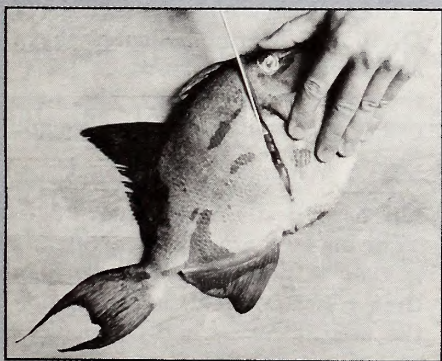
- develop a slide-tape show for sportfishing clubs, Sea Grant programs and fisheries managers.

"The concept is not to target individual fishermen, but to target sportfishing opinion leaders—marina operators, charter and headboat captains, bait and tackle shop owners, pier owners, outdoor writers, fishing club presidents and MAS agents," says Murray. "If we target these people and change their opinions about these species, they can spread the word."

Murray says he and Johnson plan to eventually reach 50 percent of the recreational fishermen in the Southeast with information about these neglected species. "We're not being naive about this effort," he says. "We don't expect everyone to know about underutilized species as soon as the project ends. Like any educational project it will take years for the information to diffuse. But we feel like we will have laid enough groundwork for that process to continue."

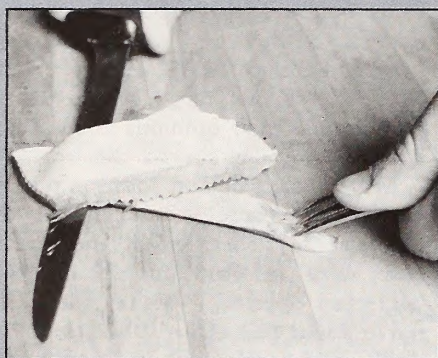
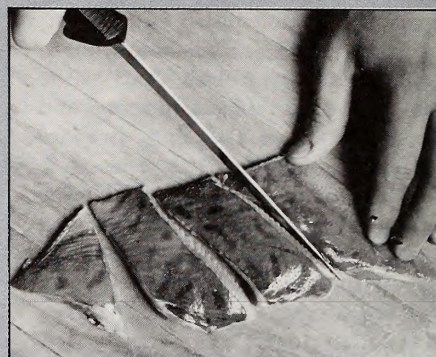
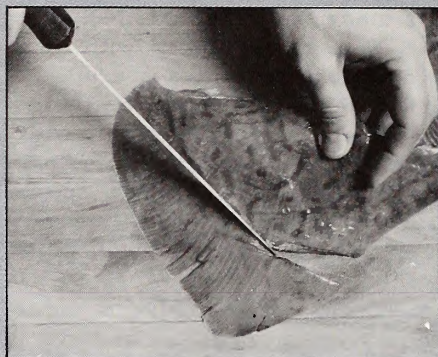
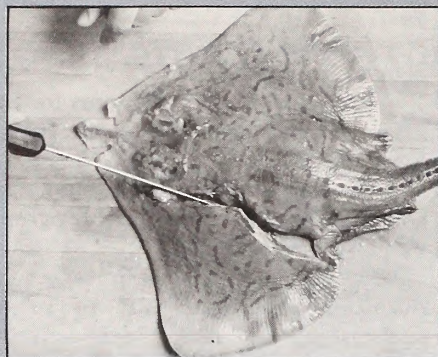
—Kathy Hart

Photos by Steve Wilson



Dressing a triggerfish:

1. Make a diagonal slice behind gill.
2. Run knife along backbone of fish, beginning at slit and working toward tail.
3. Cut away rib bones from fillet.
4. Skin the fillet.
5. White meat fillet.



Dressing a skate:

1. Cut away wing.
2. Remove thin outer edge around the wing.
3. Slice into strips.
4. Remove skin from both sides.
5. Skate meat that can be fried.

Reefs—underwater development

The most desirable neighborhood for North Carolina fish may be a community founded on the garbage of humans.

Old tires, scrap concrete and sunken ships transform barren ocean floor into some of the best real estate under water. They're called artificial reefs, and fish are moving into the new homes as fast as the state can construct them.

Jim Brown, chief of the Fisheries Services Section with N.C. Division of Marine Fisheries, says an artificial reef is "an effort by man to improve the environment and habitat so that it will support more fish." Brown is in charge of the state's artificial reef program. Since 1973, the program has established 11 ocean reefs and four estuarine reefs with more on the drawing board.

Brown says it's not hard to prove the value of an artificial reef. For anglers, man-made reefs can turn a questionable day of fishing into an almost sure bet. A study of a reef off Wrightsville Beach showed 29,000 man hours of fishing yielded 90,000

pounds of fish—about three pounds per hour. Brown says that without a reef, an hour's worth of fishing probably would result in about a pound of fish.

The reason for the difference can be found on the ocean floor. Brown likens a sandy bottom to a biological desert. "I can swim on a sandy bottom for 30 minutes in 50 to 100 feet of water and never see a fish. But I would see hundreds on a rock bottom. These rocky bottom areas support many times more biological life than sandy bottoms," says Brown.

Natural reefs attract great numbers of fish because rock outcroppings serve as attachment sites for food sources such as algae, sponges, coral and other organisms. UNC Sea Grant researchers Scott Snyder and Stan Riggs are studying rock outcroppings in Onslow Bay. To help commercial and recreational fishermen locate these prime fishing grounds, Snyder and Riggs will map the hardground formations.

When a natural reef can't be found, neither fish nor fishermen are par-

ticularly discriminating. They'll usually settle for an artificial reef.

Steve Ross, a biologist with the N.C. Division of Marine Fisheries, says fish are attracted to man-made reefs for the same reasons they like natural reefs—the availability of space and of food.

Brown says an artificial reef actually functions better than a natural reef. "The big advantage of an artificial reef is that it provides far more habitat than a natural reef, in proportion to the area it covers and the nooks and crannies it provides," says Brown.

In case you think the ocean is becoming a burial ground for man's castaways, Brown says you're wrong. An artificial reef takes care of two problems at one time. Disposal of old tires is costly and complicated, and out-of-commission ships cost taxpayers each day the vessel is at the dock, says Brown. An artificial reef offers a chance to dispose of the refuse and to improve the fisheries habitat, he says. He adds that the reef construction is environmentally safe.

(Don't assume you can dump your

old tires into the ocean. Federal and state governments require permits for artificial reef construction.)

Traditionally the state has constructed artificial reefs out of old tires, concrete rubble and ships. But tires are expensive in terms of manpower, and it's difficult to transport heavy concrete rubble to the dumping sites. Some states have even used old cars, but they deteriorate too quickly. Brown says ships offer the most shelter and extend the greatest distance above the ocean floor.

The newest addition to the state's artificial reefs will be a World War II Liberty ship. In 1972 Congress made the Liberty ships available to states for reef projects. But stripping, towing and demolition costs run high. The ships must be taken out of storage at the Maritime Reserve Fleet in Virginia and cleaned to meet Environmental Protection Agency standards. All grease, oil and floating objects must be removed. In some cases, the ships must be cut down to facilitate passage of other vessels overhead once the vessel is sunk. The value of the scrap metal was once used to offset the cost of preparing the ship for sinking. But the value of the scrap has dropped, and it is no longer economical to cut ships down.

The state must contract with a firm to tow the ship—probably about \$40,000. In all, Brown estimates it will cost \$100,000 to \$140,000 to sink the Liberty ship off the Carteret County coast.

But the Division of Marine Fisheries' 1984 budget for artificial reef construction and maintenance was approximately \$120,000—not nearly enough to cover the cost of such projects. From 1973 to 1977, one-eighth of a percent of the unrebated boater-paid road tax on gasoline was allocated for artificial reef construction. The tax provided as much as \$275,000 per year for man-made reefs. But, in 1977 the legislature abolished that tax. Division of Marine Fisheries officials hope the expanded Dingell-Johnson bill will help fill in the gaps.

This Liberty ship was sponsored by the Carteret County Chamber of Commerce. And cash has flowed in from fishing clubs, local businesses and from individuals as far away as Anchorage, Alaska. In addition, the legislature allocated \$100,000 for the project.

Brown believes the investment will be worth it. "If you increase the num-

ber of fish, that carries over into the economy of the state. It's like putting a big deposit in the bank and then living off the dividends," he says. "From that day forward, we'll be drawing returns from the fishermen who spend a lot of money getting there and then fishing."

Brown cites a study of reefs in South Carolina. For every dollar spent in construction of the reef, approximately \$10 is returned annually to the economy.

The Japanese invest millions of dollars in artificial reef research each year. Their program is so advanced that they actually develop special reefs for particular types of fish. They've found that the way a reef is put together and the complexity it has

determine which fish make it home.

It won't take long for North Carolina fishermen to see a return on the investment in the Liberty ship. Within days after it settles on the ocean floor, a food chain will begin to develop, says Ross. At first, some fish will be attracted simply because there's an object in the water column.

Then, encrusting organisms such as barnacles attach themselves to the hull. Eventually, algae grows if the water is clear and currents aren't too strong. At the same time, fish begin to move in, hiding in the nooks and crannies and nibbling on the slime collecting on the hull. The housing project nears its completion when fish such as king and Spanish mackerel,

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Photo by Mark Hooper



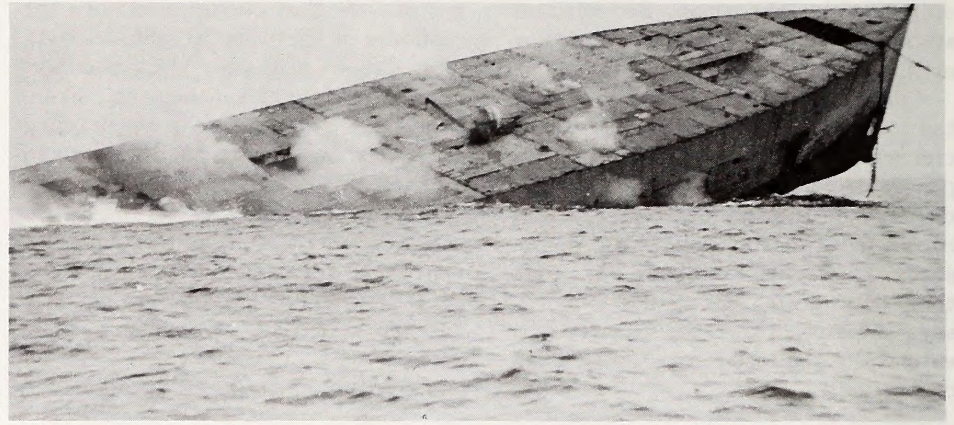
Artificial reefs attract small bait fish and, in turn, larger fish

bluefish, cobia, sheepshead, gray trout and flounder take up residence. Finally, the fishermen arrive, dangle baited lines and lure fish from their protective homes. As he pulls in a hefty catch, the fisherman proves that one man's trash may yield a fishing treasure for another.

For more information on the state's artificial reef program or the location of the reefs, contact the N.C. Division of Marine Fisheries, Box 769, Morehead City, N.C. 28557, or call 919/726-7021.

—Nancy Davis

Photo from N.C. Division of Marine Fisheries



Sinking a Liberty ship

A FADish attraction

Small bait fish are always hungry for a meal. Often they find their dinner attached to reefs, piles and sunken wrecks. But the new restaurant in town is the fish aggregating device.

As these underwater cones of nylon mesh become fouled with barnacles and tiny organisms, they attract small fish and, in turn, may attract larger fish such as king and Spanish mackerel. And mackerel are favored fish for anglers.

Last summer Jim Murray, director of UNC Sea Grant's Marine Advisory Service, and David Lindquist, a biologist at the University of North Carolina at Wilmington, tested 18 fish aggregating devices. The miniature artificial reefs were suspended in 30 feet of water 750 feet off the end of two piers in New Hanover County.

After obtaining the necessary permits from the U.S. Army Corps of Engineers and N.C. Office of Coastal Management, the researchers installed the devices off the end of one of the piers. Every six weeks, they alternated the FADs between the piers to avoid having people fishing off just one pier and to establish an experimental control.

Before beginning the project, Murray and Lindquist gathered catch-per-unit-of-effort data for each pier. They compared that data with catch information obtained after the FADs were installed to see if fishing off the piers improved. A preliminary analysis showed no significant difference in catch rates.

From visual observations Murray and Lindquist say the devices attracted bait fish but not as many large fish as they had hoped.

Jeffrey Howe, a graduate student working with Lindquist on the project, made four to six dives each week to observe the devices. He found large numbers of five- to six-inch fish aggregating around the surface buoys, the cement-filled tires anchoring the devices, and the devices themselves. In contrast, the pier without a FAD usually had no fish in the water column.

In all, Howe spotted 35 different species around the

FADs, including a few large schools of blue runners and Spanish mackerel. But he adds that the schools didn't appear to be feeding on the smaller fish.

Howe isn't sure how to explain the absence of larger fish. They may have been more skittish than the smaller fish or they may prefer the cooler water temperatures of the deep, offshore waters.

Murray thinks the FADs may perform better if they are positioned closer to the piers. Despite the disappointing results of this first test, Murray and Lindquist aren't giving up on the FADs yet. They think the bait fish may ultimately attract more of the larger fish. They'll be analyzing their data in the coming months to see if the devices might prove economical for pier owners.

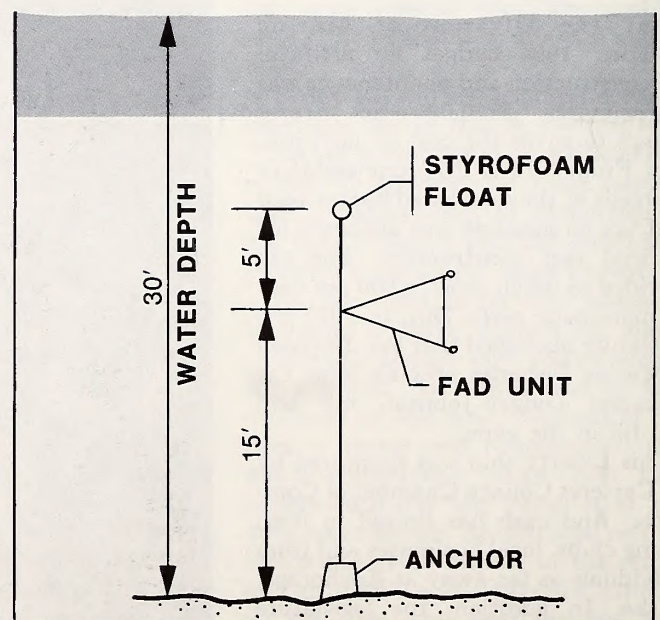


Diagram of a FAD in water

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



Take a tour through colonial history March 8 to June 6 at the "Raleigh and Roanoke" exhibit at the N.C. Museum of History in Raleigh. A collection of 157 artifacts and documents from the British Library in London will be on display, depicting life on and around Roanoke Island 400 years ago.

"Raleigh and Roanoke" will show an armor from the Tower of London; drawings and paintings by John White, governor of the "lost colony;" Renaissance maps and navigational instruments; coins; medals; books; letters and more. It will be one of the largest museum exhibits ever in the Southeast.

The display is part of the state's ongoing 400th anniversary celebration of the first English settlement in America. It traces the lifestyles of the English, Spanish and Indians at the time of Sir Walter Raleigh and the attempts to explore North Carolina's Outer Banks.

In conjunction with the exhibit, seminars; a lecture series, "Archaeology in North Carolina;" demonstrations; films; performances; and workshops will also be offered.

Children can participate, too, by visiting the museum's Discovery Room, where they can try on Elizabethan clothing and armor, use a cross staff to determine latitude and learn nautical terms and Indian words.

The exhibit is free to the public. For tours, interested school groups should call the Capital Area Visitors Center at 919/733-3456. Other groups are asked to call the museum at 919/733-3894. For further information, write the museum at 109 E. Jones St., Raleigh, N. C. 27611.



Some people feel so at home on the sea that they're making the move to live there permanently. Floating homes, which combine the atmosphere of the sea and the comforts of home, are becoming increasingly popular all over the world, including North Carolina. If you're interested in owning a floating home, there are a few things you need to know.

A new UNC Sea Grant Blueprint, *Living on the Water*, provides this information. Written by Walter Clark, Sea Grant's coastal law specialist, this publication explains the latest laws and regulations concerning floating homes in North Carolina. There are, for example, certain restrictions on mooring sites and sewage and wastewater disposal. The Blueprint also includes the addresses of several state and local government agencies for those who would like more information.

For a free copy of Clark's Blueprint, write UNC Sea Grant. Ask for publication number UNC-SG-BP-85-1.

In 1983, Hurricane Alicia hit the Texas coast near Galveston with 100 mph sustained winds. Many buildings received major damage, often from failures of poor connections in the buildings.

But in some buildings, wooden wind anchors effectively connected floor joists to floor beams without any failures. Wooden wind anchors are formed by nailing a short length of board as a spacer between a double floor beam and every other floor joist.

Spencer Rogers, Sea Grant's coastal

engineer, has written a Blueprint describing wooden wind anchors and their installation. For a free copy, write Sea Grant. Ask for UNC-SG-BP-84-3.

Seafood extension specialist Sam Thomas has left the UNC Sea Grant Program to join a private seafood company in Beaufort, N.C. Thomas had worked for seven years at the N.C. State University Seafood Laboratory in Morehead City.

As a specialist, Thomas worked with seafood processing plants on North Carolina's coast in such areas as quality control, plant expansion, and development of new products and processing techniques. He also worked extensively with blue crabs and smoked fish.

Dave Hill, a Sea Grant research technician at the North Carolina State University Seafood Laboratory in Morehead City, has retired. Hill spent much of his time at the drafting table, sketching seafood plants. He made line drawings of new plant layouts and expansions of old plants. In 1982 and 1983, 21 companies asked the seafood lab for help. Of those, seven plants are completed and operating.

Hill had been with Sea Grant since 1970.



What do you get when you cross a striped bass with a white perch? The answer: a hearty, fast-growing hybrid. You can learn how to raise striped bass hybrids in a hands-on workshop May 6 to 8 at the UNC Sea Grant Aquaculture Center in Aurora.

The workshop will offer small-group instruction on how to cross striped bass with white bass or white perch to produce a larger, more disease-resistant hybrid. Ron Hodson, project director of the center; Randy Rouse, marine advisory agent; and Howard

Continued on next page

Kerby, a UNC Sea Grant researcher, will conduct the programs. Anyone interested in aquaculture is invited to participate.

Cost for the workshop is \$60. The fee includes the sessions, publications, some meals and lodging. A maximum of 15 people will be accepted on a first-come, first-serve basis. For registration information, write Hodson at Sea Grant, or call 919/737-2454.



North Carolina's coastal resources extend beyond the sand and surf to an extensive estuarine system that serves as nursery grounds for commercially important fish and shellfish. The system is complicated, and many people do not understand it. That's why scientists and resource managers offered a public symposium on the Pamlico River Estuary March 19 in Washington, N.C.

The three-part program offered discussions on the river's fisheries, with Terry Sholar, a marine biologist at the N.C. Division of Marine Fisheries; the estuarine ecosystem and how it functions, by UNC Sea Grant Director B.J. Copeland; and how people concerned about the estuary can get involved in the decision-making process, with John Phillips, executive director of the Pamlico-Tar River Foundation.

The symposium was sponsored by UNC Sea Grant, the N.C. Division of Marine Fisheries and the Pamlico-Tar River Foundation. For more information about the foundation, call Phillips at 919/975-3680.

North Carolina Gov. James G. Martin recently appointed three UNC Sea Grant scientists to the state Marine Fisheries Commission. Sea Grant Director B.J. Copeland; Charles Peterson, marine biology professor at the University of North Carolina at Chapel Hill; and Michael Orbach, an anthropologist at East Carolina University, were among 14 selected to serve on the commission. The commission, which is made up of commercial and recreational fishermen, researchers and processors, is responsible for formulating fisheries policy.



Joyce Taylor, Sea Grant's seafood agent at the NCSU Seafood Lab in Morehead City, has completed a slide show and script on seafood care and handling. The project, sponsored by the Mid-Atlantic Fisheries Development Foundation, was designed for teachers and extension and advisory agents in the mid-Atlantic states. The slide show explains step-by-step methods for

selecting, preserving and dressing fresh finfish and shellfish.

If you'd like to borrow the slides and script, contact Taylor at the NCSU Seafood Laboratory, P.O. Drawer 1137, Morehead City, N.C. 28557, or call (919)726-7341.

The staff of *Coastwatch* wants to remind you we're purging our mailing list. We are required by North Carolina law to ask readers periodically if they would like to continue receiving our publication. If you did not mail us the card in last month's issue, you may still use it or send us your name, address, zip code and the number above your name on your mailing label. If we do not receive this information, *Coastwatch* will no longer be sent to you.

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COASTWATCH

Photo by Scott Taylor



Beaufort's restoration draws boaters and tourists from all over the world

Rediscovering the waterfront

The waterfront. For many coastal North Carolina towns and cities it has been a resource long neglected. Once the hub of commerce and travel, many waterfronts and their accompanying downtown areas fell into disrepair because of the decline in commercial water traffic, the lack of industry, the pull of suburbia and other urban plights.

But there has been a change of attitude. Local officials and residents have discovered a newfound

respect for their watery borders. They've learned that with some spit and polish, the waterfront can be a lifeline that pulls people back into downtown.

To date, Beaufort is North Carolina's most successful waterfront resurrection (see stories, pages 3 and 5). But other coastal towns and cities also are joining the revitalization bandwagon. In a survey of these cities and towns, here's what *Coastwatch* learned.

Wilmington—Local residents and tourists have rediscovered downtown Wilmington and its waterfront. Using federal, state and local money, the city of Wilmington has built a riverfront park along the Cape Fear River about one block from the heart of downtown. The revitalization was spurred by a combination of private investment (the renovation of the Cotton Exchange and Chandler's Wharf) and by the realization that the city had turned its back on a unique resource, says Michael Hargett, project director for the Riverwalk.

In addition to the park, city officials used federal funds to provide low-interest loans to downtown businesses for facade renovations and local funds to make street improvements—brick streets, special lighting and trees.

Wilmington's most recent efforts stem from a report, "Wilmington Looks to the River." The city is building a riverwalk to tie together public and private development. In addition, city officials are planning to build mini-parks or pocket parks along the 1½-mile-long riverwalk.

Hargett says private investors are responding to the city's new look. "We had one two-block area that was like a ghost town," he says. "Now that area is at least 50 percent occupied."

New Bern—If two is better than one, then New Bern should be a step ahead of the pack. It has two waterfronts—one along the Trent River and another along the Neuse River. To take on the task of revitalizing two waterfronts, New Bern citizens formed Swiss Bear Inc., a private redevelopment corporation. This group acted as a catalyst for the city's revitalization efforts, says Brad Bass, director of planning and community development.

In initial revitalization efforts, federal funds were used to leverage private money for a hotel and mini-convention center on the Trent River, Bass says. In a

second project, a river study area, called Union Point, is being developed at the confluence of the Trent and Neuse rivers. The city sponsored a design competition and selected a plan for this project. Now they are pursuing financing, Bass says.

Along the Neuse waterfront, plans call for a rehabilitation of the Holiday Inn using a combination of public and private funds. Officials are awaiting word on funding applications for this project.

Elizabeth City—Some folks say the best way to come to Elizabeth City is by boat. The city has capitalized on its waterfront by building 14 slips for visiting boaters. Called Mariners Wharf, the docks were funded by the Committee of 100, an economic development committee of local citizens. The slips, which were designed to attract boaters traveling the Intracoastal Waterway, provide 48 hours of free dockage, says Jerry Allen, the director of parks and recreation in Elizabeth City.

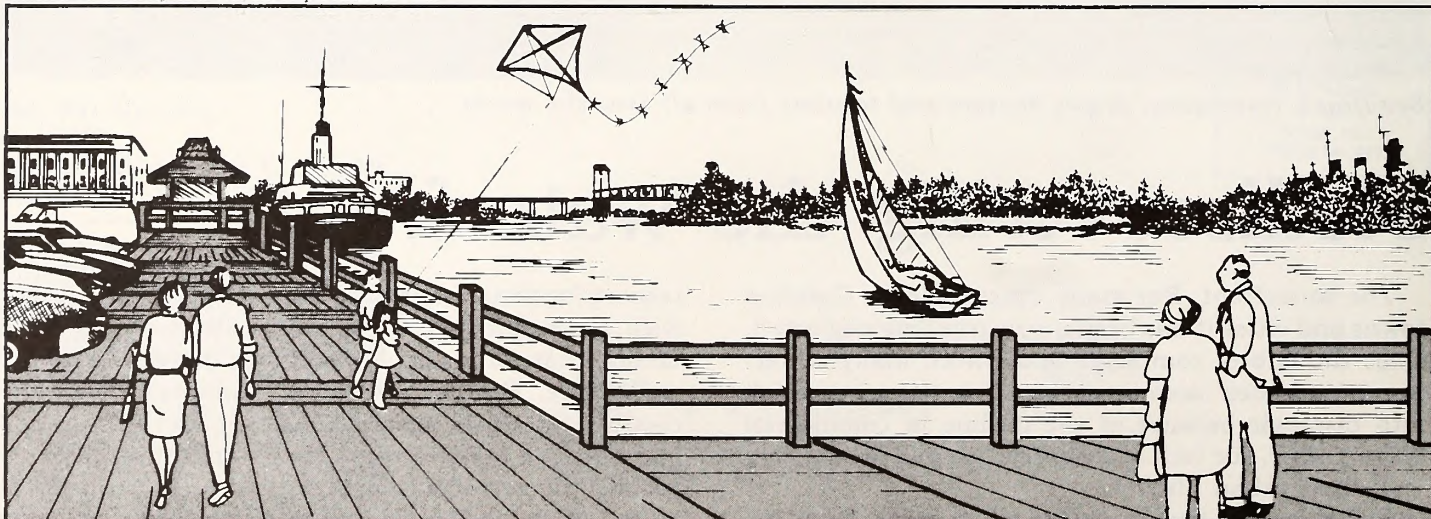
Senior volunteers for the parks and recreation department meet each visiting craft with a rose for the lady of the boat and the offer of transportation to laundries and grocery stores. Allen says the project has been extremely successful. The boaters enjoy their stay and townspeople have returned to the waterfront.

"Almost every city or town in the United States is trying to revitalize, but most of them don't have a river to work with," he says. "We feel the river is our greatest asset."

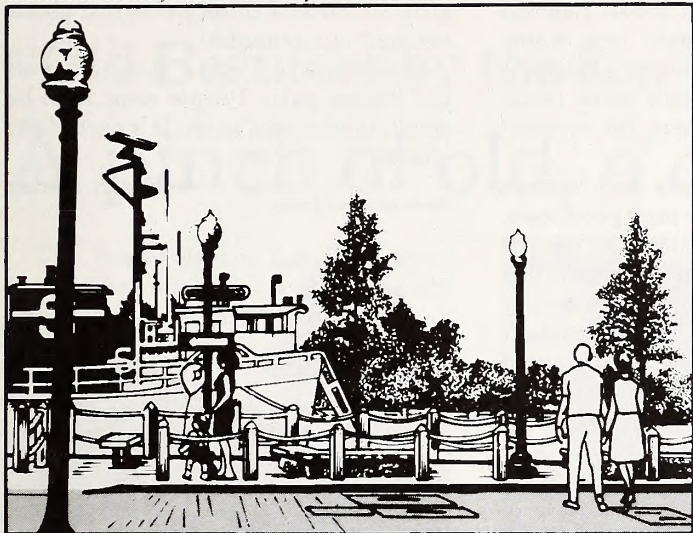
The city is also interested in developing a park area along the waterfront. Rich Novak, Sea Grant's area specialist in Manteo, is providing technical assistance to city officials planning this area.

Morehead City—Mayor Edward S. "Bud" Dixon says Morehead City will soon complete the first phase of its revitalization plan—spiffing up an

Illustration courtesy of Riverwalk Improvements Plan



Wilmington's waterfront improvements tie together public and private development



Wilmington's plans include a riverwalk

area between 3rd and 6th streets. Using state and local funds, the city has put in new sidewalks, added parking spaces, put in a new lighting system and landscaped the area. The efforts have met with the approval and assistance of Morehead City's famous restaurant row, Dixon says.

In the second phase, Dixon says the city will center its efforts between 6th and 10th streets if funding is available. In addition to city plans, two private condominium projects are planned for the waterfront.

Washington—Washington has combined revitalization and restoration into a formula that has increased its population and attracted tourists. Using urban renewal money, the city of Washington tore down the warehouses that lined its waterfront and replaced them with a driving parkway along the Pamlico River in the 1960s. Since then, the city has worked with downtown businesses and residents located near the waterfront to restore the town's historic character, says Louis Taylor, director of planning and development. New plans call for the conversion of the Old Seaboard Coastline Station and warehouse into a civic center.

Edenton—Edenton, once a busy port, has settled into a peaceful town brimming with history. Today, instead of wharfs bustling with river traffic, visitors can find tranquility in one of the town's waterfront parks or a glimpse of history on a guided walking tour of some of the town's restored homes.

—Kathy Hart

Pride whips town into shipshape

About 25 years ago, an alarm sounded in the sleepy little town of Beaufort. No one can remember its sound, but it opened residents' eyes. What they saw was a dying village. What they did was resuscitate it.

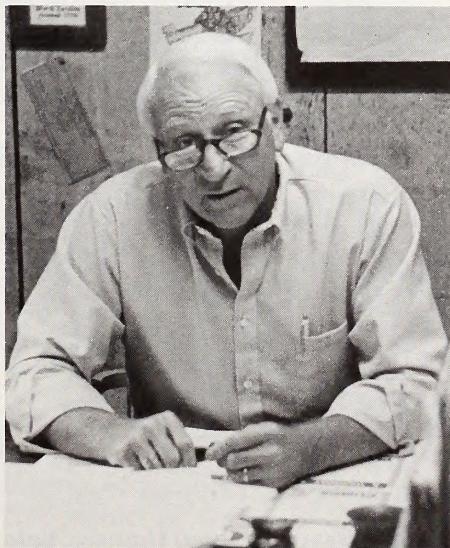
Town officials sought federal funds and raised local monies to spiff up its holdings on the waterfront. Meanwhile, private organizations spurred restoration and preservation on the homefront. The result? A thriving town that tastefully combines restoration and revitalization.

Kathryn Cloud, a member of the local historic association, thinks it was magic. Her co-worker Betty Shannon says it was hard work and love. Yet most of Beaufort's residents know it was 20 years of community effort and lots of money that changed their dilapidated town into a prosperous seaport.

In the 1950s, North Carolina's third oldest town looked its age. It had lost most of its charm to the Depression and bigger cities. The town was like a rusty antique clock stashed in the attic and forgotten.

Beaufort native Piggy Potter was mayor of the town then. He tells a story that describes the town's state: "We put up street lights on Front Street and somebody asked me why," says Potter. "I told them, 'So you can see the rats running across the street.'"

Photo by Sarah Friday



A.C. Blankenship

Empty stores lined the harbor, 200-year-old houses and historical landmarks sat in disrepair and people moved away. At the docks, natives saw only half a dozen ships.

"The whole town was deteriorating," says A.C. Blankenship, town administrator and a resident of Beaufort for about 40 years. "The business district had deteriorated. The tax base had dwindled away . . . The town went for years and couldn't pay their debts." In 1963, Beaufort was \$10 million in debt.

But a small group of concerned citizens recognized the value of their prized clock and set about removing it from storage, buying it new parts and shining it up a bit. The group, now the Beaufort Historical Association, realized something needed to be done if the town's unique history were to be preserved and if their children were to stay there, says Mayor Joyce P. Fulford.

The Beaufort Historical Association began its efforts during the town's 250th anniversary. For the celebra-

Continued on next page

tion, the association opened several of the older homes that were in good condition for tour. And to increase community pride, they established a plaque program, giving historical markers to restored homes 100 or more years old. After the town's anniversary, the group raised money to improve other houses and buildings now on display in the Historical Complex area of Beaufort.

"Since then it has been a going thing," Fulford says. "As the years have progressed, as people see things come about, the people want to get involved."

Preservationists, administrators, women's clubs, the Beaufort Jaycees and the Garden Club were a few who got involved. Beaufort was in the process of getting back on its feet in 1963, says Blankenship, when it began a major thrust of its revitalization campaign—urban renewal.

Most of the citizens and the commission wanted to bring in new businesses that would help the county. Because they justified the improvement would bolster the economy, Beaufort received a federal grant for more than \$1.2 million. And in 1968, the town approved a \$250,000 bond referendum to aid in the urban renewal.

The commission originally planned to rebuild 18 blocks near the waterfront. However, federal funds were cut during President Richard Nixon's administration, and the area was reduced to two blocks on the south side of the main street, Front Street.

The revitalization was a joint effort between the historical association and the urban renewal project, says Blankenship. The association worked with the commission to devise an area that would complement the town's historic, friendly atmosphere.

"In the beginning, when we had the referendum, there was some opposition," says Blankenship. "Since that time, since the project has been implemented, the majority of those people that were against it are not now."

By 1976, five tracts of land were cleared for the businesses that the commission agreed would be appropriate. Construction began for the new bulkhead and boardwalk, and areas were designated for paving and parking.

In addition, Beaufort later qualified for an additional \$1 million community development block grant as a

result of receiving the urban renewal grant. With this money, new water and sewer lines were put in a blighted area of town, and funds were made available to homeowners for renovation.

Today, most residents and visitors agree the changes have been good ones. The historical association has opened 10 structures for tour and awarded more than 100 plaques throughout Beaufort. The downtown project brings in sailors from all over the world and new developers to the outskirts of the town. Apartments, shopping centers, subdivisions, inns and new businesses have located in the county, helping to bring the 1983 tax base to \$75 million.

Waterfront revitalization proves to be a solution for many dying coastal towns and cities. But Beaufort's story reads like a fairy tale, say Cloud and Shannon. "The magic ingredients just happened to come together," boasts Cloud.

Nearly 4,500 people live in Beaufort now, and about 1 million visit it annually. As in the past, natives and sailors are lured to the port's good fishing, safe harbor, stately homes and quaint shops along the waterfront.

Blankenship and Fulford believe the growth and development has leveled off. "I feel we've accomplished a lot of goals," says Fulford. "We can just

grow so much. I think we've just about reached our potential."

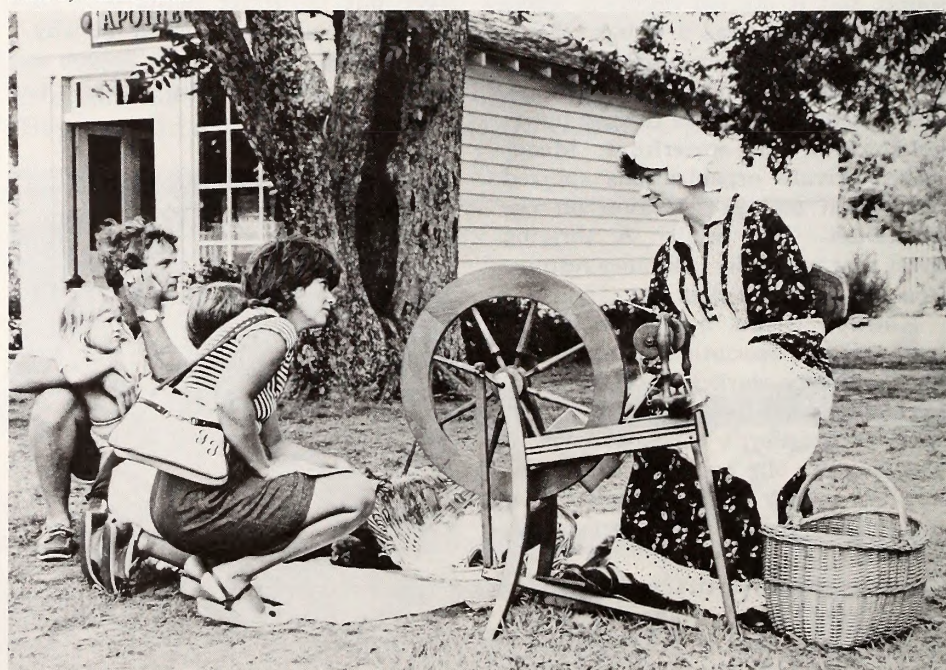
Besides, says Cloud, "Beaufort is off the beaten path. People want it to be small, quaint and quiet. It's part of the charm."

— Sarah Friday

Photo by Sarah Friday



Photo by Tabbie Nance



Above, Beaufort courthouse; below, tourists peek at the past in the town's Historical Complex

"Old Beaufort by the Sea"

A pinch of old, a dash of new

The double-decker bus pulls away from the curb, and 85-year-old Grayden Paul begins his spiel. It's all about how Beaufort's name used to be Fishtown, changed to Hungry Town after the Tuscarora Massacre, then to Paradise, and finally settled on Beaufort, after the Duke of Beaufort in England.

By this time, the English bus has reached the Old Cemetery. Soldiers from the Revolutionary and Civil Wars are buried there, he's proud to tell you.

The tour continues. It's the same lecture Paul has given for nearly 50 years to one group or another. Sometimes his audiences are summer tourists. Other times, it's a chartered group that has called with a special request for a tour. Paul is always glad to oblige. He is as much a part of Beaufort history as the centuries-old houses he describes.

But as Paul winds his tour through the historic streets, the visitor notices a contrast. Across the road from Beaufort's historic district, a spanking-new building houses a collection of specialty shops and blocks the view of Taylor's Creek and nearby Carrot Island. Tourists stroll down a freshly-planked boardwalk that stretches for several blocks along the city docks. Where they once would have seen the rusty steel hulls of menhaden vessels, tourists now gaze at 50-foot sailboats and yachts.

For 276 years "Old Beaufort by the Sea" was a fishing village. When it was founded in 1709, it served as a haven for whale fishermen. Centuries later, the menhaden industry kept the town thriving.

In 1985, this waterfront village is a mix of the quaint and the cosmopolitan. The old and the new stand side by side, integrated into what has become one of the biggest successes in waterfront revitalization on the East Coast.

The Beaufort that has emerged is attracting new businesses, new residents and an influx of tourists. Charles McNeill, curator of the N.C. Maritime Museum, has watched Beaufort's

Photo by Tabbie Nance



Grayden Paul aboard double-decker tour bus

progress. He attributes the success of the revitalization to the town's geographic location. From here, it's a quick hop to the Virgin Islands, or sailors can go north through Pamlico Sound and avoid the infamous Graveyard of the Atlantic.

That prime geographic location has replaced the 80-some menhaden boats that used to dock on the waterfront with the masts of 150 to 200 sailboats. They come in search of protected anchorage and quick access to the sea lanes. Within 10 minutes, a boat can

be in the open sea, says McNeill.

A logbook at the Maritime Museum is testimony to the popularity of Beaufort as a layover for boats. Sailors passing through sign their names, identify their boats and state their destinations. The list reads like scenes from an exotic travelogue. Places like Quebec, Canada; Stockholm, Sweden; Sydney, Australia; Wimbledon, England. And if that's not enough to impress you, famous newsman Walter Cronkite once anchored here, and Jacques

Continued on next page

Cousteau made Beaufort a port of call.

The restoration has even attracted a luxury passenger service vessel—a mini-Love Boat of sorts. The cruises of about 100 passengers travel the Intracoastal Waterway, stopping off in Beaufort for a day of sightseeing.

Inevitably, some of those just passing through have decided to make Beaufort their home, leaving fewer and fewer residents who are as native to the area as Grayden Paul.

Nancy and Mike Barton are two transplants to Beaufort. They moved here last year after four years of traveling and living on a boat. When they decided it was time to return to land, they faced a decision. They wanted to open a business; but where?

They narrowed the choice down to an area around the Chesapeake or Beaufort. Nancy says Beaufort won hands down. They had sailed through the town before and found it "quaint and unspoiled."

The Bartons, along with several other business partners, are renovating one of Beaufort's oldest homes into a country inn.

Beaufort natives praise and curse the town's restoration. Yes, times have changed, says Grayden Paul. But he's pleased with the progress. If it means more folks get to see his beloved town, it's all right by him.

Since he moved there from Davis in 1922, Paul has watched Beaufort make a complete circle, from thriving fishing village to ghost town and back to vibrant seaport.

Through the changes, the boardwalk has remained the social center of the community, says Paul. "In 1912 Front Street was paved. The tide came right up over the road to the houses." Paul says residents walked uptown via the

boardwalk that was built over the street because the rising tide often covered the road.

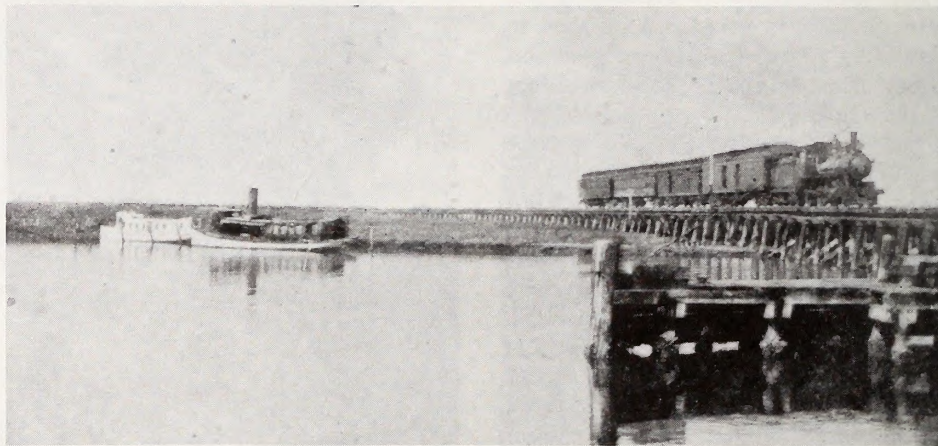
In those days, the men of the town gathered around the pot-belly stoves in the waterfront stores. "All the fishermen and the hunters would sit around and talk until late," says Paul. "Even the barbershops stayed open til 12:00 on Friday and Saturday nights. Now they stay open six or eight hours

a day and charge you \$5 a haircut." Times *have* changed in Beaufort.

Today it is a modern historic village. A contradiction in terms, perhaps, but a successful contradiction. The town's ability to shove some of its past aside while retaining much of its beginnings has resulted in a combination that may keep Beaufort alive for three more centuries.

— Nancy Davis

Photos from N.C. Division of Archives and History



Turn-of-the-century photos of Beaufort's railway and waterfront

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—Commercial fishing

—Mass media

—Educator

—Seafood processing/marketing

—Farming

—State government

—Homemaker

—University professor/researcher

—Lawyer

—Other _____

Coastal property owner ☐ yes ☐ no Boat owner ☐ yes ☐ no

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



In November 1983, Coastwatch reported that marine advisory agent Jim Bahen was experimenting with a shrimp trap. Now, after gathering a season's worth of data, the results are not encouraging, says Bahen.

With the help of two graduate students from the University of North Carolina at Wilmington and the N.C. Division of Marine Fisheries, Bahen began testing the devices during the brown shrimp season and completed his experiments during the white shrimp season. Similar to miniature crab pots, the shrimp traps are 16-inch cubes made of fine wire mesh, with two side openings, a central bait well and two passages to the main body of the trap.

The researchers wanted to find out if the traps would catch shrimp, where they would be most effective, which bait attracted the most shrimp, and what size wire mesh would allow smaller shrimp and fish to escape.

Bahen reports that the quantities of shrimp harvested during the test period did not prove the traps to be economically feasible. Changes in wire mesh size, location and time of sets, and baits made little difference.

In one experiment, the researchers placed a trap in a 250-gallon aquarium to test the behavior of the shrimp. They found the shrimp were able to go in and out of the large-mesh traps at will. The 1/2-inch mesh seemed to work best at retaining shrimp.

However, if the shrimp were left in the trap for more than three hours, they eventually found their way out.

Bahen says he will run additional tests on the shrimp traps during the 1985 season. If his results vary, Coastwatch will let you know.



What's outselling books by former U.S. Senator Sam Ervin and NCSU basketball coach Jim Valvano? Well, in one Raleigh bookstore, it's a book about fish.

Fisherman's Guide: Fishes of the Southeastern United States by Charles Manooch III, a research biologist with the National Marine Fisheries Service's Beaufort Laboratory, is on the bestseller list for recreational and commercial fishermen alike. The book includes over 250 species of freshwater and saltwater fish from Delaware through Florida and color paintings of 150 of those most often caught by recreational and commercial fishermen.

Fisherman's Guide explains how to identify the fish, provides life history, habitat and distribution information, and presents methods of catching and preparing the fish. The 362-page book is published by the N.C. State Museum of Natural History with collaboration from the International Game Fish Association, the National Wildlife Federation, the N.C. Wildlife Federation and the Sport Fishing Institute. The cost is \$24.95.

For a copy, write the N.C. State Museum of Natural History, P.O. Box 27637, Raleigh, N.C. 27611. Or call 733-7450.

Lundie Spence, UNC Sea Grant's marine education specialist, is offering to conduct in-service training programs for teachers or other educators using her new Sea Grant publication, *Coastal Capers*. The 76-page booklet provides educators with marine-related, interdisciplinary ac-

tivities for lower elementary students and youth groups such as 4-H or scouts. It is illustrated with reproducible art that can be used with the capers—"Let's go fishing," "Fishy fun," "What bird are you," and more.

To arrange a training program, write Spence at UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Or call 919/737-2454. For a copy of the booklet, write UNC Sea Grant. Ask for UNC-SG-84-05. The cost is \$3.50.

If you're planning a beach trip this spring, you'll want to know which seafoods are in season. If crabs and scallops are your favorites, you'll be in luck in April. But if you prefer oysters, you'll have to wait until October or November.

To help make your selection, Joyce Taylor, Sea Grant's marine advisory agent at the NCSU Seafood Laboratory in Morehead City, prepared a colorful 17-by-22-inch poster depicting the seasonal availability of North Carolina seafoods. The chart is based on North Carolina commercial landing statistics and is intended as a guide for buying fresh fish and shellfish. For a single free copy of the poster, write Sea Grant. Ask for UNC-SG-84-04.



Harold the Lobster's days at the N.C. Marine Resources Center on Roanoke Island are numbered. Sometime this summer, probably in May, the 17-pound lobster will leave his home of over a year and make his permanent residence at the Virginia Museum of Marine Sciences.

Harold's capture last year off the Virginia coast spurred a petition to save the lobster from the pot. In the wake of the protest to commute Harold's sentence, the seafood company's owners agreed to donate the giant lobster to the Virginia Museum of Marine Sciences. Since the facility

Continued on next page

wouldn't be ready until this summer, Marine Resources Center Director Rhett White offered the crustacean refuge there.

Probably the largest and oldest lobster in captivity, Harold has been a major attraction at the center since his arrival. If you want to catch Harold's show before he moves on, visit the center located on Airport Road north of Manteo on Roanoke Island. Center hours are Monday through Friday, 9 a.m. to 5 p.m. and weekends, 1 to 5 p.m.

King mackerel won't take the only prizes at this year's Scotts Hill King Mackerel Tournament. The largest amberjack, a traditionally underutilized species, will also earn a prize.

As part of his National Marine Fisheries Service grant to increase the use of underutilized species by recreational anglers, Marine Advisory Services Director Jim Murray will offer samples of cooked amberjack to tournament participants.

The tournament is scheduled for May 30 through June 1 at the Scotts Hill Marina in Scotts Hill, N.C. For entry rules, write the marina at Rt. 1, Box 541 AC, Wilmington, N.C. 28405.

To help fishermen avoid costly hangs that can destroy nets and waste precious fishing time, UNC Sea Grant offers *Hangs and Obstructions to Trawl Fishing*. The book was com-

piled from the records of trawler captains, who were willing to share their hang logs with others. It lists hangs by loran headings and covers waters off the Atlantic Coast from Cape Cod to Florida.

For a copy of the book, write UNC Sea Grant. Ask for UNC-SG-83-01. The cost is \$2.



Crab shedding has become a booming seasonal business in coastal North Carolina. But before setting up your shedders, read UNC Sea Grant's latest Blueprint, *Estimating Cash Flow Generated by Crab Shedding Enterprises*. In this blueprint, Jim Easley, an extension economist at North Carolina State University, shows fishermen, in a step-by-step manner, how to estimate net cash flow for two types of shedding systems—floating and flow-through. Floating systems use cages in a natural body of water to hold peelers during shedding. Flow-through systems are onshore shedding facilities that pump natural water through tanks and return it to its source.

This blueprint is a supplement to *A Guide to Soft Shell Crabbing*, a UNC Sea Grant publication written by marine advisory specialist Wayne Wescott. For a free copy of the blueprint, write UNC Sea Grant. Ask

for UNC-SG-BP-85-2. For a free copy of *A Guide to Soft Shell Crabbing*, ask for UNC-SG-84-01.

The N.C. Marine Resources Center at Bogue Banks has the right touch when it comes to kids. There, children of all ages can learn about marine life firsthand with two new touch tanks scheduled to open in April.

The tanks will model North Carolina's rock jetties and the animals that are found near them. Horseshoe crabs, sea urchins, starfish, spider crabs, toadfish and other fish will be swimming and crawling in the tanks, says Mark Joyner, aquarium specialist with the N.C. Office of Marine Affairs. And with each tank about three feet deep, says Joyner, there will be a lot of creatures to see and touch.

The official dedication of the tanks will be May 30 at 7:30 p.m. at the center.

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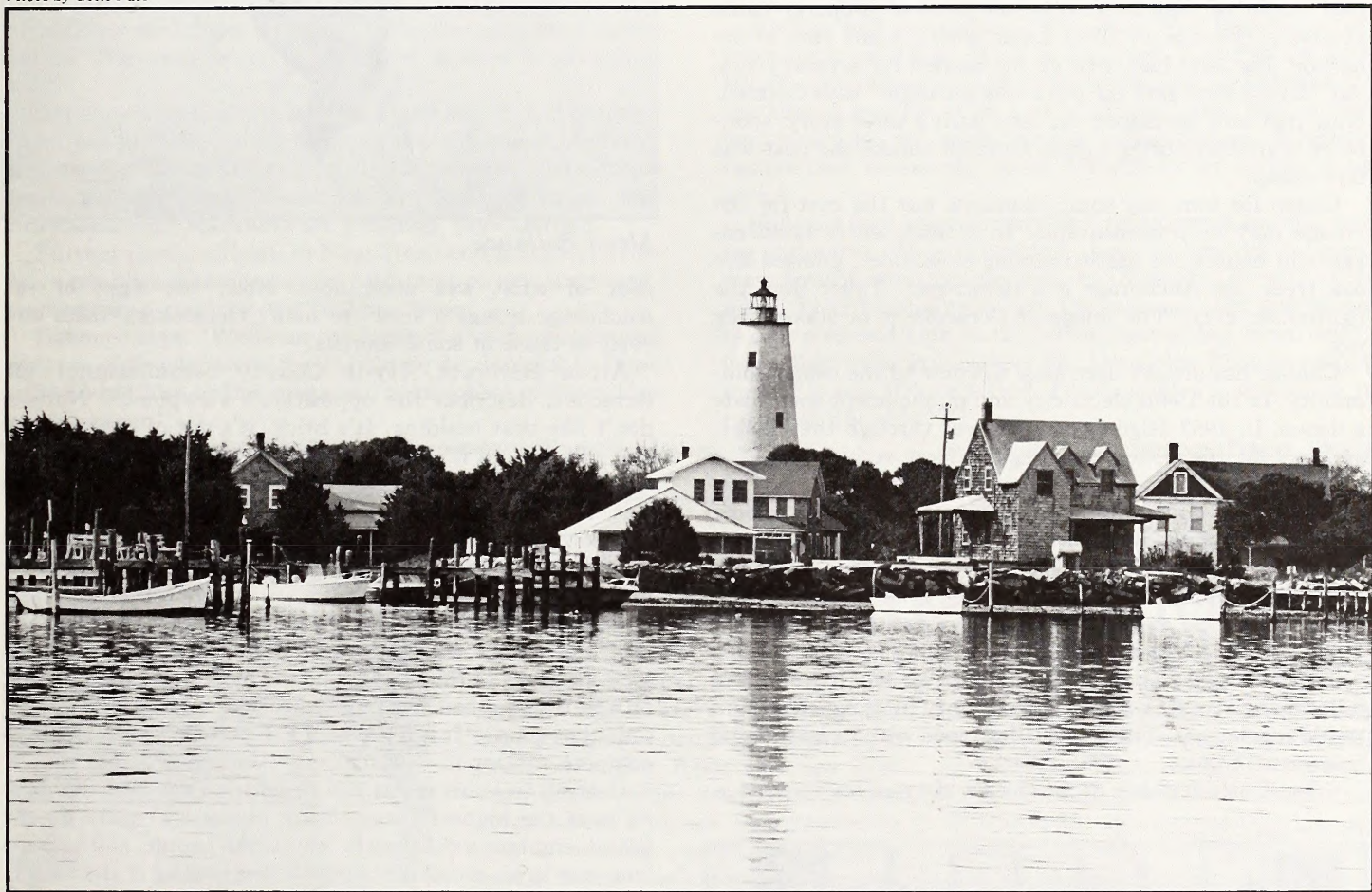
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COASTWATCH

Photo by Gene Furr



A view across Silver Lake, Ocracoke's picturesque harbor

Change sweeps Ocracoke Village

It's happened almost everywhere else on the North Carolina coast. A quiet stretch of sand attracted only the heartiest settlers. They made a living by fishing and depended on their neighbors for help when times got rough.

But then folks began to find out about the secluded coastline and the village. A retreat, they called it. Mostly they came to unwind, to be soothed by the sea. When they went home,

they told their friends about the beautiful place. And before the natives knew it, their quiet home had turned into a tourist spot.

So it is with Ocracoke, perhaps the state's last frontier. This month, Coastwatch takes a look at Ocracoke Island and its village. Against the backdrop of a rich history and fishing heritage, Ocracoke is changing. And change is not always welcome.

What kind of image to present?

In 1975, a businessman from Daytona Beach, Fla., flew over Ocracoke Island. "From the air, it looked like something out of a storybook," remembers Scott Cottrell. "I thought it was one of the most picturesque places I had ever seen."

Cottrell landed on the island, took a look around and bought a piece of property. Four years later, he moved there for good, with the intention of taking it easy.

But he opened a gift shop, and the businessman in Cottrell began to take over. Another piece of property came available, this one on Silver Lake, with a prime view of the harbor. The land had been on the market for several years, but "Everybody said the price was too high," says Cottrell. Now that he's developed the land with a three-story, soon-to-be-four-story, brick motel, Cottrell thinks the cost was dirt cheap.

Cheap for him, say some islanders, but the cost for the village may be immeasurable. In a town where hundred-year-old houses are nestled among even older, gnarled live oak trees, the Anchorage is a skyscraper. Taller than the lighthouse, even. The image of Ocracoke is at stake, they say.

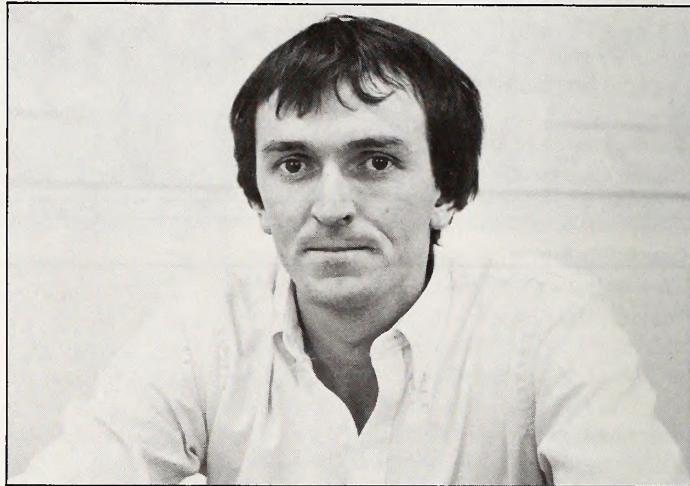
Change has always been slow to come to the island community. In the 1940s electricity and public telephones made a debut. In 1957 Highway 12 was cut through the village, and in 1961 the state began regular ferry service from the mainland.

Today, the unincorporated village is a permanent home to over 650 people, most of them with roots several generations deep. Here, the mass exodus from the country to the city doesn't apply. Ocracoke's children grow up there, some go off to school, and more often than not, they return.

When Cottrell constructed the Anchorage, his actions were not illegal. The only guidelines he was required to follow are those set out by Hyde County building codes and septic regulations. The motel is equipped with its own septic treatment system.

What Cottrell didn't do was follow the natives' unwritten

Photo by Nancy Davis



Alton Ballance

code of what was acceptable. Now, the sight of the Anchorage brings a scowl to many Ocracokers' faces and even to those of some tourists.

Alton Ballance, Hyde County commissioner for Ocracoke, describes the opposition's viewpoint: "Natives don't like that building. It's brick, it's out of character to the village, and it's high-density for such a small lot. The Anchorage sets a precedent—if he can build that, I'll build this. If he builds four stories, I'll build five."

(Scott Cottrell and Alton Ballance reflect the extreme points of view and do not necessarily represent the opinions of other Ocracokers.)

Cottrell defends his motel. When completed, a pitched roof and gables will give the building a more traditional look, he says. "I think it will be the most imposing building on the island when it's finished," says Cottrell.

Is that good? "It is if it's your's. But it isn't if you have to compete against it," he replies.

Cottrell feels his motel has benefited Ocracoke. He says he pays the highest taxes of any business venture on the island, employs a substantial number of people, and tourists who stay in his motel contribute to the income of the island.

But the Anchorage is only the focal point of a broader conflict. Ballance says this is a story about natives losing ground.

He creates a common scenario. Two neighbors have lived on Ocracoke all their lives. When one of the homeowners dies, the relatives decide to sell the property.

Here's where the trouble begins, says Ballance. A retired couple from the North buys the house. Then they want to buy an adjacent vacant field. The natives see the land as an old field where their children played. To the newcomers, the property is a way to make money, says Ballance. They buy the land and build a motel.

Now the natives have to deal with commercial property next door. They rebel; their home isn't a nice place anymore, says Ballance.

A zoning plan might have helped in a situation like this,

Photo by Nancy Davis



Scott Cottrell

says Ballance. But on Ocracoke, where fierce independence and individualism runs as deep as the distrust for government, residents opposed a 1981 zoning referendum 424 to 238. Some say the referendum didn't pass because it was too complicated and wasn't explained clearly. Others say natives were afraid the ordinance would backfire on them, that they wouldn't be allowed to do what they wanted with their land, that they couldn't keep boats and crab pots in their yards.

Irvin Scott Garrish, Ballance's uncle, was a county commissioner at the time the zoning ordinance came up for a vote. He was in favor of the law, but he accepts the fact that residents defeated it.

Now, another new motel blocks his view of Silver Lake. "I'm selfish. I didn't want that in front of me," he says as he points to the motel. "But I couldn't help it. People were afraid they would lose some of the freedom they have on the island. The freedom to do what they wanted to with their land."

Ballance and Garrish believe problems of overdevelopment are just beginning. Already, the water and electrical utilities feel the added burden. In the summer, it's not unusual to be without water for two to three hours, and brownouts and blackouts are common, says Garrish.

Further north, officials in Nags Head and Kill Devil Hills have established temporary moratoriums on new water connections as a result of the building boom.

Ballance says, "We're on the brink of a very unorganized pattern of development that would be detrimental to those utilities but also to the image and atmosphere of the village environment."

Cottrell says he voted in favor of the zoning ordinance. "I

believe orderly, controlled growth is preferable to random growth," he says.

But there is a double standard at work on the island, says Cottrell. "The feeling of the natives is, 'Don't do this with your property, but don't tell me what I can do with mine.'"

Cottrell doesn't think overdevelopment will be a problem on Ocracoke because the amount of land available for purchase is limited. The 775-acre village lies at the southern tip of the island. The remaining land on the 17-mile strip of beach is owned by the National Park Service.

Ballance disagrees. "Every piece of land is available on this island. If you've got the money, you can buy it."

Garrish says some natives are selling their land. He's not among them. "I have my land and my daughters have their's. I'm holding a piece for my grandson. If I didn't, it would be almost impossible for him to have land here."

Natives and newcomers alike agree that land prices increase with each day. Mary J. Everhart, a transplant from Illinois, is building an eight-unit motel. She paid \$70,000 for less than a quarter of an acre on Silver Lake. Half of that land must be set aside for the septic system. Everhart figures that means she spent \$70,000 for an eighth of an acre.

Ballance isn't sure whether he'll recommend another zoning ordinance. He's concerned that random development may destroy what people come to Ocracoke for in the first place. "I'm beginning to get the message that people are taking a second look at the advantages of big construction in a village-type atmosphere like Ocracoke. They're waking up and going, 'Oh, my God, I had no idea it was going to turn out like this.'"

—Nancy Davis

Photo by Gene Furr



The Ocracoke Lighthouse

The ties that bind

It's said Ocracoke's solitary nature and watery surroundings breed a special people—people who draw strength from the sea and enjoyment from the simple life. They show a fierce independence and a strong community spirit borne from isolation and hardy living. Their roots reach deep into the island's history, holding neighbor to neighbor and generation to generation. The ties that bind—the island, the water, the heritage—make these people Ocracokers and everyone else an outsider.

Their history began with a brush from Sir Walter Raleigh's 1585 expedition. The expedition's flagship, the *Tyger*, ran aground in what was believed to be Ocracoke Inlet, then called Wococon Inlet. The island itself also bore the name of Wococon, an In-

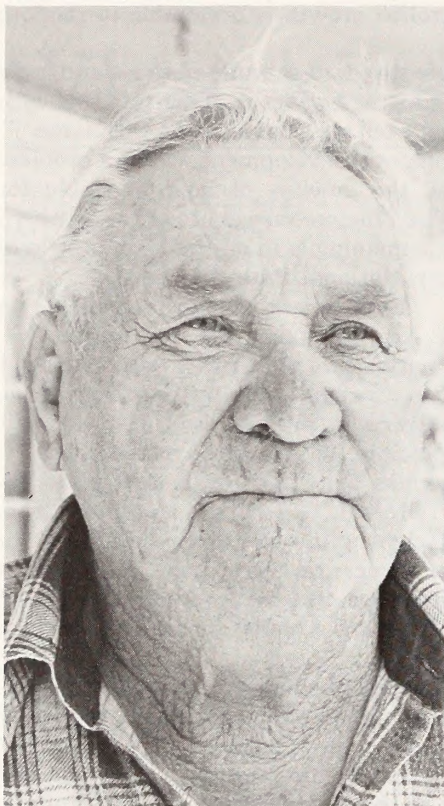
dian word meaning fort.

The name gradually evolved to its current form—Wococon, Woccock, Occocock, Oceacock, Ocracoke. Legends say the infamous pirate, Blackbeard, is responsible for its present-day name. Impatient for dawn and his ensuing battle with a British sloop, he cried, "O crow cock!" "O crow cock!" Less glamorous, but more likely, the name changed because of speech variations.

Even if Blackbeard did not christen Ocracoke with its name, he did fire its history to a dazzling start. Blackbeard, more correctly Edward Drummond, used North Carolina as the base for his pirating operations prior to 1718. His favorite refuge? Ocracoke.

But Virginia's royal governor, tired of Blackbeard's embargo on Chesapeake trade, sent two sloops to stop him. Finding the pirate at

Continued on next page



Chris Gaskill

Ocracoke, the sloops attacked. During the ensuing fight, Blackbeard received 25 wounds before dying. His head, severed from his body, was hung from the ship's bowsprit, and his body thrown overboard, where legend says it swam around the sloop seven times before sinking.

In Blackbeard's day Ocracoke stretched to a length of eight miles. During the 1700s it joined Hatteras Island for a union that was ended by an 1846 hurricane. From the breakup Ocracoke would gain eight additional miles of soil.

In 1715, the Colonial Assembly recognized a settlement of ships' pilots on the island and later appointed the settlement a town. The pilots guided ships through Ocracoke Inlet, making it the primary trade entrance for North Carolina. During the Revolutionary War the pilots helped patriots channel needed supply ships through the passage.

After the war two entrepreneurs bought a small nearby island—a massive bed of oyster shells—that stood adjacent to the channel leading from Ocracoke Inlet to the sound. The men used the island, named Shell Castle, to offload supplies from seafaring vessels to smaller craft for shipment inland.

Between 1798 and 1803, Congress authorized the construction of a 55-foot, wooden-frame beacon on Shell Castle Island. It stood for about 15 years before it burned down.

To replace the Shell Castle beacon, Congress appropriated a new lighthouse on Ocracoke Island. Built at a cost of \$11,359.35 in 1823, the Ocracoke Lighthouse stood 75 feet tall and included a one-bedroom keeper's quarters. The tower, which still cautions mariners today, is the second oldest operating lighthouse in the United States.

Even a lighthouse could not save all ships from the storms and shoals. About 40 vessels were reported lost near Ocracoke's shores. But many crew members were rescued by the heroic efforts of the villagers.

What the sea so readily took from these seafaring schooners, it often returned to its island neighbors. Ocracokers found the cargoes—lumber, shoes and china—washed ashore or available for easy pickings in the surf. Elizabeth Howard, a 75-year-old native, says her house was constructed from the lumber carried by the *Noamis*.

Christopher "Chris" Gaskill, another Ocracoke native, recalls a vessel known as "the banana boat." The ship, laden with hundreds of bunches of green bananas, ran

aground. "They wanted to lighten up the ship to pull her off so they gave us all the bananas we wanted," Gaskill says. "I must've taken 200 to 300 bunches. I carried 'em to Washington and sold about 100 for 50 cents a bunch to a wholesaler." Older residents like Gaskill and Howard still shake their heads over the banana boat because of the island-wide sickness that occurred after villagers gorged on green bananas.

For Gaskill, another story of wreckage carried a special message. On a March morning in 1941, Gaskill was driving along the beach. He spotted some wreckage—not unusual for Ocracoke. But something drew Gaskill to take a closer look. He found the wreckage to be the door from a pilothouse. On the back of the door was the master's license of his cousin, James Gaskill. The freighter his cousin captained had been torpedoed by the Germans offshore.

A board bearing the freighter's name, *Carib Sea*, also washed up in front of the young man's Ocracoke home that day, Gaskill says. Several weeks later, the family was officially notified of James Gaskill's death. The sea delivered its message faster.

German torpedoes also sunk the *HMS Bedfordshire*, a British trawler, off of Ocracoke in 1942. Gaskill found one of the four bodies that

Photo by Clay Nolen



The lighthouse stands guard over an island steeped in tradition

washed ashore. The villagers, knowing of no way to transport the bodies back to Britain, buried the men in a small cemetery on Ocracoke, Gaskill says. In 1976 North Carolina leased the cemetery to Great Britain, and today it is a famous landmark on the island.

Every coastal village has a story about the "worst hurricane," and Ocracoke is no exception. Howard and Gaskill say the worst storm of their lifetimes came in 1944, the hurricane Howard calls "The Great Atlantic." "I was shelling shrimp when I noticed the water coming in the yard," she says. "It kept coming and coming. Finally the sound and the sea met. There was 12 inches of water in this house. Fish washed into some houses and trawlers

were pushed onto land."

Howard's recommendation for weathering a hurricane, "go to bed and sleep. I haven't ever worried about a hurricane."

But if hurricanes didn't stir excitement among the natives, some of the island's famous visitors did. Ernest Hemingway was said to have visited Ocracoke. And Charles Lindbergh made an overnight stay. "My father cooked dinner for Lindbergh," Gaskill says. "His plane lit down. He said he had been flying right much that day and was wondering if he could spend the night." And Gaskill himself met Lady Bird Johnson, whose visit to Ocracoke was such a well-kept secret that Gaskill had to produce a

photograph to prove to his wife he had indeed luncheoned with the first lady.

But the famous and not-so-famous have long sought Ocracoke's quiet shores, Howard says. She remembers tourists arriving by steamer from Washington and New Bern. But then, "They stayed all summer," she says. With the tourists came night after night of dances at the Pamlico Inn and blocks of ice cream on Sunday.

Then, sheep, cows, ponies and hogs ran wild on the island; there was no sheriff; and you could walk across the entrance to Silver Lake (then called Cockle Creek) with your pants legs rolled up, Gaskill says. "Things have changed plenty—too much," he says.

—Kathy Hart

School days on Ocracoke

Ocracoke School has no football team, no cafeteria and no school bus. What it does have is 93 students in kindergarten to 12th grade, a school newspaper that reaches beyond the island to over 40 states and the support of all 650 or so of the island's permanent residents.

It's a unique school. A handful of teachers instruct students at 13 levels of education. Brothers and sisters sit side-by-side in classrooms. And every student, from the kindergartener to the twelfth grader, gets a vote in choosing this school's homecoming queen.

Most of the island natives attended the school. For the first quarter of the century, the school housed only eight grades. For more education, students were sent to a boarding school in Washington. But in 1931, Ocracoke School graduated its first senior class.

Principal Ernest Cutler says the school's size fluctuates. When he came to the school nine years ago, 82 children studied there. Then the number gradually rose to 121. But lately it has dropped again.

Cutler says three of this year's eight graduating seniors have spent all of their schooling years here. "In a school this small you learn the students' weaknesses and they learn mine," he says. Although he can't offer students a wide selection of electives, he says the school does offer a lot of personal attention.

Each year a driving teacher comes to the school to provide one month of classroom instruction and practical road experience. He allows each student to make a trip to Manteo, where they will encounter stop lights and turn lanes for the first time. And, of course, they learn the all-important practice of boarding a ferry.

Athletics take on a different focus on Ocracoke. There are not enough boys in the high school to field a football team. Consequently Ocracoke "is a basketball town," says Kevin Cutler, the principal's son and a graduate of the school.

But even basketball presents problems. Only a few

Photo by Kathy Hart



Ernest Cutler

other schools will travel to the island to play. To provide additional opposition, local men and women form teams to play the high schoolers, Kevin says. And it's during the height of basketball season, not football season, when the Ocracoke School selects its homecoming queen.

Ernest Cutler says most of the graduating seniors stay on the island or, if they do go away, they eventually come back. His son puts it like this: "Once you've lived here for any length of time you can't get it out of your system. In your mind you always want to go back to Ocracoke."

A heritage founded on fishing

There's not much Charlie Williams likes more than putting his nets off Ocracoke Island—unless it's talking about it. Charlie, 71, and his brother James, 76, have been fishing and guiding around those parts for most of their lives. It's a way of life for them and a heritage they want to keep.

"I tell everybody today that I am a fisherman," says Charlie. "I'm proud to tell it... that I'm a commercial fisherman. What I've got now, I've got because I was a fisherman."

People like Charlie and James preserve the traditions of hard work and good fishing in the quaint village off North Carolina's Outer Banks. For centuries, the sun and sea have directed the lives of Ocracokers, providing food for the table and money for their pockets. Unlike trade and tourism, fishing persisted through the years, tying together the past and present like a strong piece of rope.

"It was a way of survival," says Charlie. Until World War II, the island's economy centered around commercial fishing. Few other jobs were available. There were no industries and only a handful of shops, inns and restaurants.

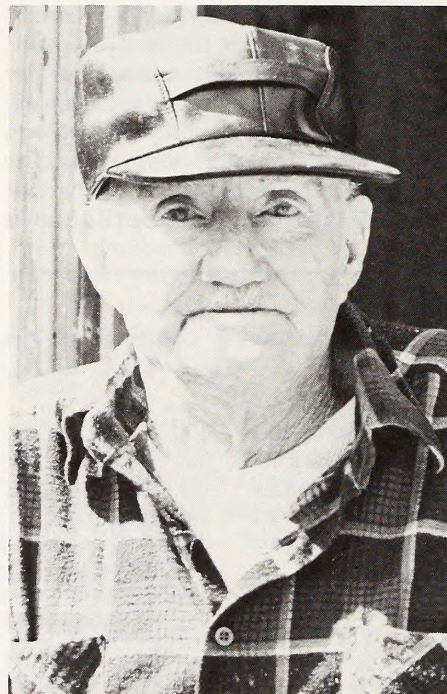
Ocracoke's size and location proved to be assets for the fisheries. Because it was out of the way, few outsiders dropped their nets in surrounding waters. The ocean and Pamlico Sound teemed with mullet, bluefish, flounder, mackerel, trout, croaker, spot and other fish. Fishermen pulled in plenty of oysters, clams, crabs and shrimp, too.

Sullivan Garrish and his brother, Uriah, admit that the fishing and bragging came easy sometimes. "We used to catch 14 and 15,000 pounds in a day," says Sullivan. "There was a lot of times when we couldn't bring them all in in our boats." He recalls one trip in particular when they had to get another boat's crew to help them pull 10,000 pounds of bluefish out of their gill net.

The old-timers agree commercial fishing is not easy work. Sullivan said he and Uriah were out before sunrise every morning, weather permitting, from May to October. After netting all the fish they could catch, the crew took several hours to cull, clean, salt and pack the fish in barrels for ship-

ping. Not much fresh fish was sent from the island then. And occasionally instead of shipping their catch, the islanders would swap the fish for a load of vegetables from the mainland.

Photo by Sarah Friday



Sullivan Garrish

"We had to catch a lot of fish then to make any money," says Sullivan. Now and then, they'd come to shore with a boatload of fish, only to discover there was no market. "Me and Uriah... several times we didn't make enough to pay the fuel bill." But, "You can't let it lick you. Sometimes we'd go out and not catch anything. Next thing you'd know, you'd make a hit."

The unpredictability of catches was one of several factors forcing most fishermen out of the industry in the 1960s and 1970s. Fish houses closed. And the lack of profit forced the young islanders to look elsewhere for employment.

Wayne Teeter, 40, was one of those young people. "No young ones were getting in it. It was the thing not to do." At 17, Teeter knew if he wanted a job he'd have to leave the island. He enlisted in the Coast Guard for 10 years.

Ocracokers who once turned to the sea for employment began working in the island's growing tourist industry.

Today the small village opens its doors to thousands of visitors from around the world. To accommodate them, gift shops, motels, restaurants, water sport rentals, park and ferry services keep the locals busy most of the year.

"Right now when you speak of the economy of the Outer Banks, it's tourism," says one fisherman. "There's still some commercial fishing, but not like the old days."

The opening of a new fish house, South Point Fish and Crab Co., in 1976 is credited for reviving Ocracoke's fishing industry and the job market. About 120 people fish commercially now, says Teeter, but less than a fourth of them work full-time.

"You can still whack a living out of it," says Teeter, who took up fishing part-time after returning to the island. Most of the commercial fishermen crab now because it brings more money—30 cents a pound. A thousand pounds is a good day's catch. But to be a successful commercial fisherman these days, "You've got to do different things different times of the year," says one fisherman. In the winter, trout and croaker are good catches, and in the summer, crabs, clams and flounder sell well.

"You can make as much as you want," says full-timer Tom Leonard. Financially, the fisheries are better off than in years past. What you pocket depends on how much time and effort you want to put into it, he says.

Freedom is one of the reasons Teeter continues to fish commercially. "There's nobody to bother you when you're doing it." He also fishes because it's something he knows. He taught himself the art, getting a few tips from his grandfather. For Teeter and many other Ocracoke fishermen, the traditions tied to fishing are as much a part of their lives as fish stew and cornmeal dumplings.

"Fishing hasn't changed a lot here with the Ocracoke fishermen," says Charlie Williams. Certain things draw the young ones to the sea, just like it has the old. "It's just like something with a string on you," he says. "You just have that urge to be out on the water."

—Sarah Friday

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



The North Carolina Maritime Museum in Beaufort opened the hatches of its new home and set sail May 18. The all-wooden building, which cost \$1.5 million, will be a showcase for the museum's displays of maritime and coastal natural history.

With 18,000 square feet, the new facility on Front Street has four times the space of the old museum. There's an auditorium now, and more exhibit and storage space, says Charles McNeill, museum curator. Larger exhibits will be displayed, such as a 15-foot scale model of a fully-rigged menhaden boat, typical of those once found at Beaufort's docks.

The new building is a "culmination of a lot of dreaming," says McNeill. "We don't expect to change things that much in terms of the scope of the museum. It's still going to be about 50-50 natural history - maritime history. We'd like to keep it that way."

This unique blend of history enables the museum to offer exhibits and field programs that interpret numerous themes. Present displays include marine artifacts, ship models, photographs, sea- and shore-bird mounts, shells and marine fossils. Field trips and special programs take visitors to coastal habitats such as salt marshes, tidal flats and rock jetties.

The museum is open year-round, seven days a week. Hours are: weekdays, 9 a.m. to 5 p.m.; Saturday, 10

a.m. to 5 p.m. and Sunday, 2 p.m. to 4:30 p.m.

For more information about the museum and its programs, write N. C. Maritime Museum, 315 Front St., Beaufort, N.C. 28516.

Can a breakwater withstand the forces of nature—high winds and strong currents? That's what Spencer Rogers, UNC Sea Grant's coastal engineering specialist, will find out when he constructs a 48-foot breakwater along the sound at the N.C. Marine Resources Center in Manteo.

The project, which will be supported by the Sea Grant Marine Advisory Service, will test a wooden breakwater's ability to endure severe estuarine conditions. Rogers will build the breakwater, using the best design available, then let Mother Nature go to work.

Watch the Back Page to see how the breakwater fares. If successful, the breakwater will become a public demonstration site. Homeowners and builders can see firsthand what materials and methods were used.



If mosquitoes bug you in the summer, you may want to build a bird house for purple martins in your backyard. The migratory songbird has long been known for its ability to devour insects, especially mosquitoes.

Purple martins flock to North Carolina from South America during the warmer months. They make their homes throughout the state, including at the coast and on the barrier islands where mosquitoes are numerous, says James Parnell, a biologist at the University of North Carolina at Wilmington.

Since purple martins nest in small colonies, multi-compartment houses or hanging gourds make suitable homes. But the N.C. Wildlife Resources Commission has another idea. An 8-foot piece of PVC (polyvinyl chloride) pipe can be made into an attractive,

durable home for 10 to 12 pairs of purple martins at a reasonable cost.

To construct such a bird house, divide the 6-inch diameter PVC pipe into sections by inserting round wooden discs at 6-inch intervals. Drill a 2-inch-wide entrance hole into each compartment, attach perches (small pipes or dowels) and cap the top end of the pipe. All materials can be purchased for about \$30.

For complete plans of the PVC pipe house for purple martins, write the Division of Conservation Education, N.C. Wildlife Resources Commission, 512 N. Salisbury St., Raleigh, N.C. 27611.



If you want to take an underwater view of the latest shrimp trawling systems and techniques, call your local marine advisory agent. He can arrange a viewing of a film on shrimp trawls. Produced by marine advisory services from the southeast, in cooperation with the National Marine Fisheries Service, the film provides shrimpers with information that will help them decide which system is best for their operation.

The film shows how trawl and door designs and shrimping techniques have changed since 1958. It also describes common rigging adjustments and how they affect trawl performance and how gear selection and fishing techniques affect fuel efficiency.

If you would like to see the film, contact your local Sea Grant agent to make the arrangements (northern coast: Wayne Wescott, 919/473-3937; central coast: Bob Hines, 919/247-4007; and southern coast: Jim Bahen, 919/458-5498).

Jim Murray, director of Sea Grant's Marine Advisory Service, has been elected president of the N.C. Wreck Divers' Association. In addition to its goal of education about diving safety, the organization holds monthly meetings, publishes a monthly news-

Continued on next page

letter and entitles members to reduced rates on diving trips.

Membership is open to anyone in the state, but most of the approximately 75 members are Research Triangle area residents. The fee is \$15 per year. For information about joining the Wreck Divers' Association, write Murray at Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605, or call 919/737-2454.



Shape up for summer with seafood. Joyce Taylor, Sea Grant's seafood agent at the NCSU Seafood Laboratory in Morehead City, reports that seafood is not only high in protein, vitamins and minerals; it's also low in calories, fat and cholesterol.

For example, an average portion of fish generally provides about half the recommended daily allowance of protein for adults. And shrimp contains about 20 percent protein—more

than in hamburger, sirloin steak or pork.

The percentage of fat and calories found in most fish is low when compared to other meats. A 3½-ounce hamburger contains about 21 percent fat and 268 calories. The same portion of some fish may contain less than a percent of fat and only about 75 calories. (Values will differ for each species of fish.)

Compared to other protein sources, fish contain small amounts of cholesterol and the saturated fats that have been linked to heart disease, says Taylor. Most fish contain healthy concentrations of trace elements, minerals and amino acids.

The N. C. National Estuarine Sanctuary is accepting proposals for federally funded research in the four components of the state's sanctuary system—Zeke's Island, Rachel Carson (Carrot Island, Bird Shoals), Currituck Banks and Masonboro Island. Awards will be made to pro-

jects that enhance scientific understanding of sanctuary ecosystems and provide information for coastal management decision makers.

All proposals must be received by June 15. For a copy of the guidelines and the necessary forms, write: Sanctuary Analyst, N.C. National Estuarine Sanctuary, Division of Natural Resources and Community Development, Coastal Management, Raleigh, NC. 27611-7687.

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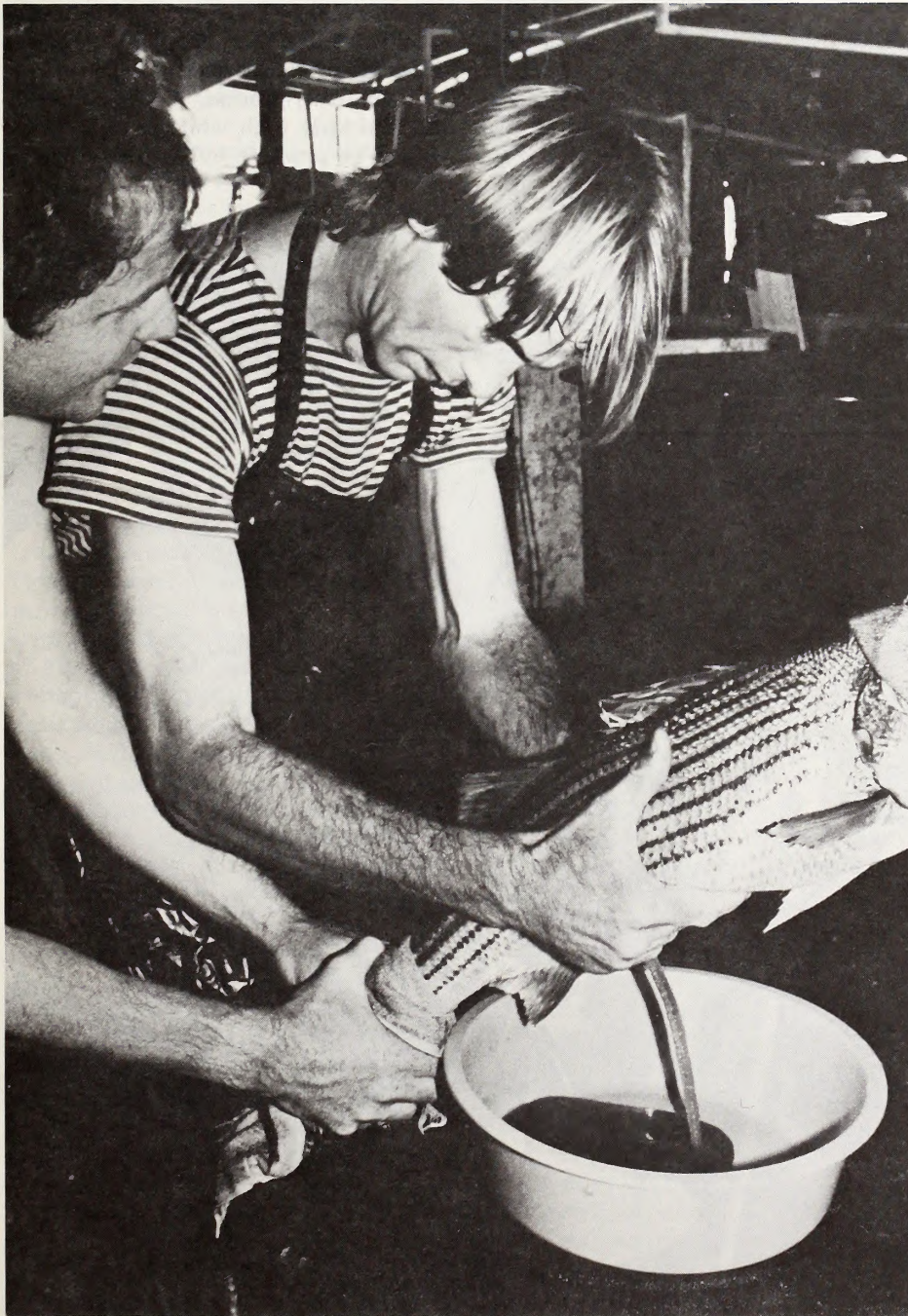
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COASTWATCH

Photo by Doug Yoder



Technician Tom Blevins squeezes ripe eggs from a female striped bass

Aquaculture

Shrimp, catfish and mussels—they're often harvested from the wild, but they have cultured counterparts. Fish farmers, or aquaculturists, nurture these species from egg or larvae much like the farmer raises a crop from seed.

The aquaculturist tends pools and ponds just as a farmer tends fields and livestock. Daily, the fish are fed and the oxygen content of the water monitored. When the fish reach optimum size, they are harvested.

Why go to all the trouble? In some cases, natural stocks are dwindling. Worldwide, most species are fished to maximum levels. The bottom line: There's too much demand and not enough supply.

Aquaculture alleviates some of these problems. It provides a consistent quality and steady supply of these species.

Already North Carolina has a flourishing aquaculture industry. In 1984, this state was the second largest producer of rainbow trout in the nation.

But Sea Grant researchers think there is an even more promising culture candidate. The striped bass hybrid offers culturists a hardy, fast-growing culture species.

This month, *Coastwatch* examines the culture of striped bass hybrids.

Fish of a different breed

For years, scientists manipulated the genetics of plants—corn, tomatoes, cucumbers—to develop hybrids. This manipulation allowed farmers to get more and better food to the American table faster.

Now UNC Sea Grant scientists are applying genetic manipulation to fish. The striped bass. Howard Kerby and Mel Huish, zoologists at N.C. State University, are crossing striped bass with white bass or white perch to develop a hybrid.

Today this type of genetic manipulation is loftily called biotechnology. But its aim is more down-to-earth—to produce hardier, faster growing hybrids that can be raised commercially in culture conditions.

Kerby and Huish chose to work with the striped bass because of its declining natural stocks. Commercial and recreational fishermen have long sought the striped bass for its highly prized meat. But as stocks declined, the fish became harder to find. To save the fishery, resource managers in states along the East Coast have begun limiting commercial catches. (Such a regulation was being considered by the N.C. Marine Fisheries Commission when *Coastwatch* went to press.)

A substitute was needed to fill the commercial demand for the striped bass and to remove pressure on the unstable natural population. The hybrid answers both these needs, offering culturists an opportunity to produce a high quality, high-priced fish.

But Kerby and Huish's work goes beyond just crossing striped bass with white perch and white bass. They are genetically manipulating the fish to improve the production potential of the hybrid and to develop a domesticated hybrid brood stock. The development of a brood stock would alleviate the need to collect scarce wild fish and would streamline the production of hybrids for culturists.

At a recent striped bass workshop sponsored by UNC Sea Grant, Kerby put his genetic knowledge on display. Female striped bass taken from the wild during the spawning season were

injected with hormones to induce ovulation. Twelve hours after the fish were injected, Kerby began sampling the eggs to predict when they would ripen. Upon ripening, the eggs were manually squeezed from the females. Likewise, sperm were squeezed from white bass males.

Kerby produced gynogenetic diploid and triploid hybrids. What does this mean, you ask? Well, it's all in the chromosomes.

A diploid is any fish with a normal number of chromosomes. Like humans, most fish have 48 chromosomes.

To produce gynogenetic diploids—essentially clones—Kerby irradiates the sperm from the male fish to destroy its chromosomes. After the sperm fertilizes the females' eggs, the eggs are heat- or cold-shocked or chemically treated to retain an extra set of chromosomes the female usually ejects. The fish still ends up with 48 chromosomes, but they are all contributed by the female, making the fish a virtual clone of its mother.

Using this process, Kerby can cross striped bass with white bass or white perch to produce hybrids, then clone

Photo by Doug Yoder



Howard Kerby tests the water for dissolved oxygen

the biggest and best hybrid offspring. Unlike many hybrids, this cross is capable of reproducing. The cloning also would alleviate the need for acquiring or maintaining two different parental stocks.

To make triploids, Kerby does not alter the white bass sperm, which allows the male to contribute 24 chromosomes. But after fertilization, the striped bass eggs are again heat-shocked to retain the extra set of chromosomes. Therefore triploids have 72 chromosomes and are, in theory, sterile.

This sterile hybrid has several advantages, Kerby says. If the hybrids are accidentally or purposely set free in the wild, they would not crossbreed with natural stocks to alter their genetics. "Some scientists speculate that the sterile hybrids grow faster because none of their energy is channeled into reproduction," Kerby says.

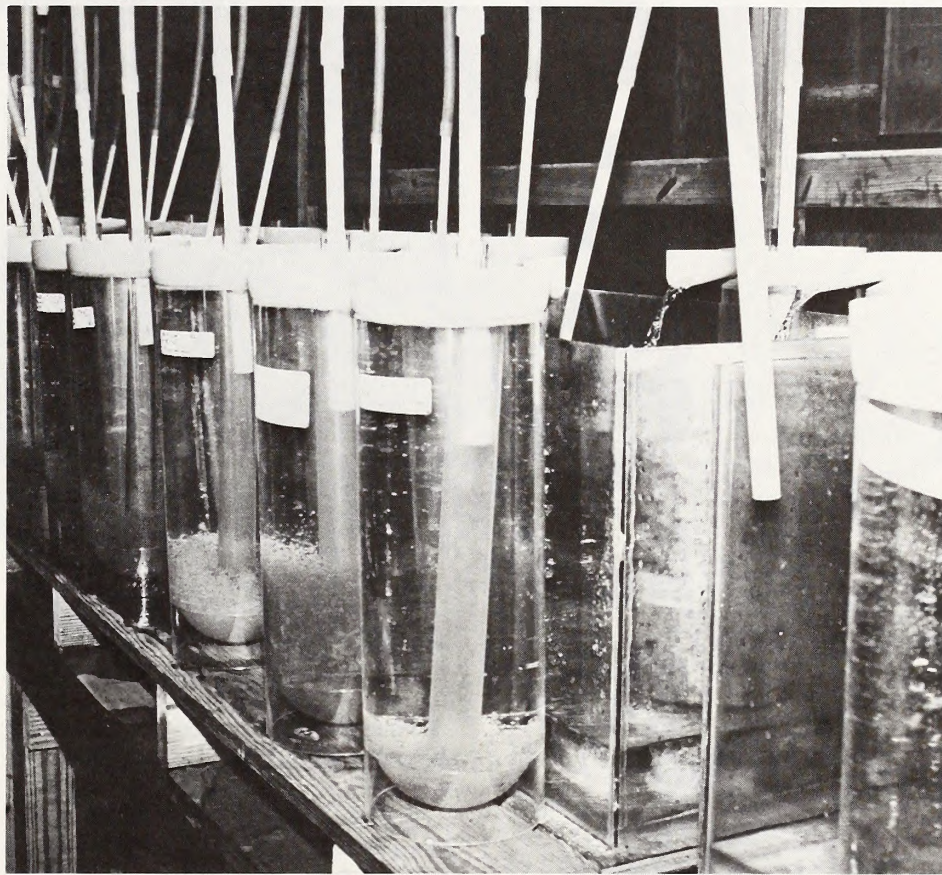
Next year, Kerby will work toward creating tetraploids, or hybrids equipped with 96 chromosomes. If these fish are not sterile, the tetraploids could be crossed with diploids to produce triploids naturally. "Creating a brood stock of tetraploids would be an easier, more practical way to produce triploids," Kerby says.

All of this genetic manipulation is naught if the hybrids don't thrive and grow under culture conditions. But in the case of the striped bass hybrids, grow-out is not a problem. Kerby stocked the fish in earthen ponds, in freshwater flow-through circular pools and in floating cages placed in brackish estuarine waters. In all cases, Kerby was able to produce marketable fish (1½ pounds) in 14 to 18 months, and the survival rate for hybrids stocked as fingerlings exceeded 70 percent.

At the experiment's completion, the researchers harvested 5,291 pounds of fish per acre from the ponds and 60 kilograms per square meter from the cages. The pond harvest of hybrids compares favorably with catfish culture. For the lower-valued catfish, 4,900 pounds of fish per acre is considered commercially viable.

To boost growth even more, Margie

Photo by Doug Yoder



Eggs incubate in hatchery at Aurora lab

Gallagher, a UNC Sea Grant researcher at East Carolina University, is working with the protein/energy ratios in fish feed. "In fish, the requirement for protein is complicated by the fact that dietary protein can and is used as an energy source," Gallagher says. "Therefore in studies of protein requirements of fish, it is necessary to look not only at the effect of protein levels on growth and metabolism, but also the effects of protein/energy levels on these processes."

Gallagher's research with elvers, or baby eels, showed that diets too high in energy restrict the fish's feeding to the level where the elvers don't meet their protein requirements. But if the energy level is too low, protein will be wasted for use as energy instead of being used for growth. These findings confirm earlier research on other species: fish eat to meet energy needs rather than their protein needs.

Focusing on striped bass hybrids, Gallagher is looking for that optimum ratio of energy to protein needed to spur growth. The proper ratio will not only result in larger, faster-growing hybrids, but it also will lead to a better and more cost-effective feed for the hybrid.

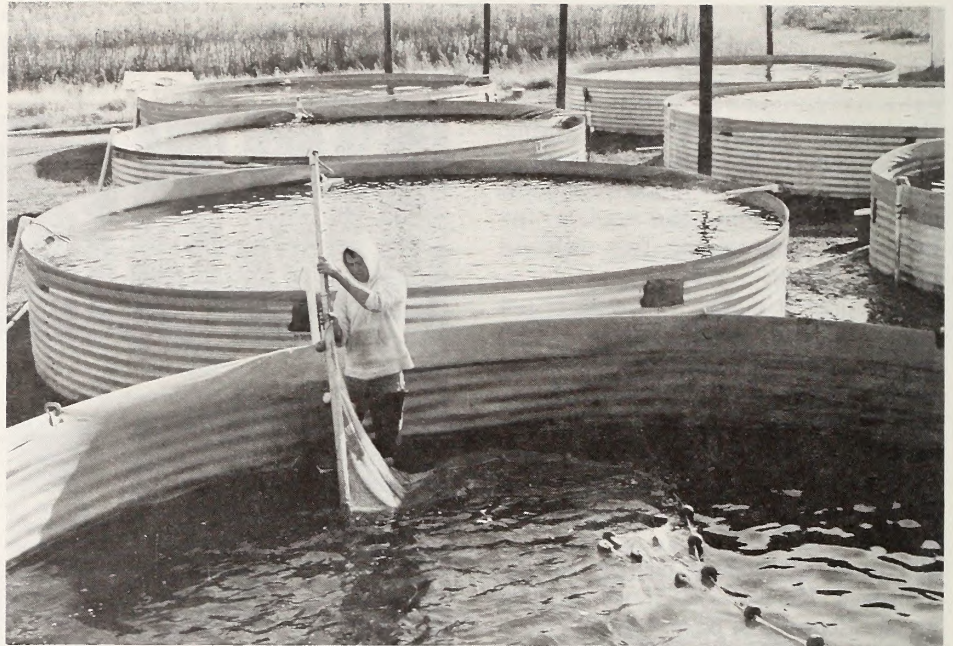
As in other forms of aquaculture, feed costs are a major part of the total cost of production. Because striped bass hybrids require a high protein diet and protein is the most expensive ingredient in their feed, it's very important to maximize its return.

As Sea Grant scientists work out the genetics and feed requirements of striped bass hybrids, many believe the fish is ready to leave the laboratory. The striped bass is no longer a potential aquaculture candidate, scientists say, but one on the verge of commercial success.

—Kathy Hart

Fish Farming

Photo by Howard Kerby



** Chris Okano fished for striped bass for eight years until he finally went broke, he says. Instead of giving up on fishing altogether, Okano has decided to try another angle—raising striped bass hybrids in a culture operation.

** B.E. Singleton Jr.'s 40-acre pond near Washington, N.C., may serve a dual purpose. He uses it to pump sand for his concrete business, and he'll try to raise striped bass hybrids in its waters.

** In Columbus County, the Wacamaw-Siouan Development Association has constructed 12 quarter-acre ponds for raising channel catfish and striped bass hybrids. Executive Director Gloria Patrick says the association will use the ponds to show local farmers how they may be able to supplement their incomes.

So far, aquaculture is only a fledgling industry in coastal North Carolina. But it's people like Okano, Singleton and Patrick who may push the industry from the fledgling stage into viability.

At a recent Sea Grant workshop, 20 participants joined a team of researchers and advisory personnel to find out more about the potential for the industry here—particularly for the striped bass hybrid.

Ron Hodson, UNC Sea Grant

associate director, offers three reasons why hybrid culture looks promising: "It grows faster, is more disease resistant and hardier than either of the parent species. It has potential because of the market for striped bass that is already available. And in North Carolina we have the water and the climate for this particular species."

But even with such positive outlooks, Randy Rouse, marine advisory agent at Sea Grant's aquaculture facility in Aurora, cautions potential aquaculturists to investigate the market before investing time and money in an operation. "Set up ahead of time where you're going to sell your product and how much you're going to sell it for," says Rouse. If you determine that there is a demand for hybrids, you're ready to proceed.

Your water supply may be the most important consideration, since its quality has a lot to do with the fish's overall health.

Surface water, ground water or brackish estuarine water will do. Next, evaluate the water. You'll need a hardness of at least 50 parts per million and a pH between 6.5 and 8.5. Check for toxins, particularly in surface waters from a farm. Runoff from chemically treated fields could degrade the water quality.

The next step is to obtain a fish propagation permit from the N.C.

Wildlife Resources Commission. (All fish culture operations require permits.) Fishery biologist Bill Smith says the commission will consider the species you want to raise and the potential effect on nearby natural watercourses. If you divert water from a stream or river, you must return water to that watercourse. And, the commission wants to be sure none of the cultured fish can escape into the natural watercourse and possibly inbreed with natural stocks.

Now, you're ready to decide what sort of operation you want. Do you want to set up your own hatchery and raise fish to the fingerling size? Or do you want to buy fingerlings and raise food fish?

If you're going to sell the fingerlings as "trained-to-feed," you'll need pools where you can teach them to eat a pelleted food. Trained-to-feed fingerlings command a higher price, says Rouse.

You may opt to sell your excess fingerlings, retaining enough to raise as food fish. In that case, you'll need 1- to 5-acre ponds constructed for seining and draining. A large farm pond with a sufficient source of water would suffice. If the pond is too deep for seining, you may be able to float net pens and keep the fish contained.

To get maximum production from the ponds, you'll need an aeration system to maintain the oxygen levels in the water. And you should invest in an oxygen-monitoring kit.

The fish will have to be fed two to three times a day, either manually or with an automatic feeder. The feed for the fish is perhaps the greatest expense you'll encounter—as much as 40 to 50 percent of your costs. Depending on the feed conversion rates, it may take as much as 25,000 pounds of food to yield 10,000 pounds of fish. At 20 to 25 cents a pound, the feed costs could add up to \$6,250. All factors considered, Hodson estimates hybrids can be raised for about \$1 per pound and may bring from \$1.50 to \$2.50 depending on where you market them.

It takes about two growing seasons to produce marketable 1- to 1½-pound fish. By seining his pond, an aquaculturist could begin selectively harvesting toward the end of the second season. When the remaining fish reached the desired size, he could

Photo by Doug Yoder



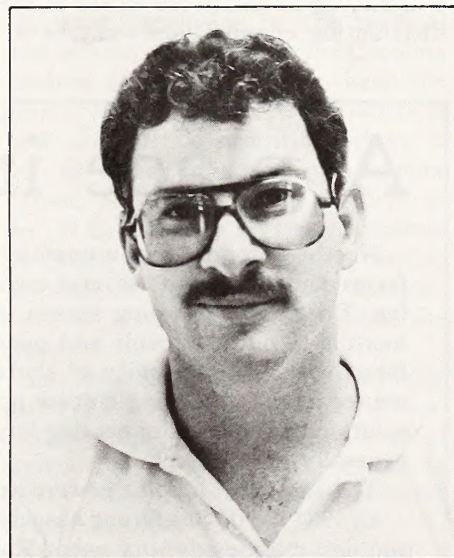
Workshop participants heat-shock fertilized eggs

harvest by draining his pond.

Your job is not completed when you harvest the crop. Gary Van Housen, Sea Grant's seafood marketing specialist, has some advice for potential aquaculturists. "A lot of aquaculture operations have either ignored marketing or not given it the consideration it deserves. If you have the knowledge of raising fish, put at least some time into researching the market for your fish."

Van Housen believes there is a potentially strong market for hybrids. He points to a 1981 National Marine Fisheries Service survey that indicates people in the mid-Atlantic region consume more fresh fish than people in other areas of the country. Add to that the popularity of striped bass in these same states, and the hybrid looks like a winning product.

Now define your market even more. Will it be home consumers, retail fish markets or restaurants? Van Housen points to the results of the same survey. It found that of the 29 percent of fish that is eaten fresh, only 8 percent was actually eaten at home. Twenty-one percent was consumed in restaurants. That might indicate that you would want to look at the



Randy Rouse

restaurant trade rather than selling to retail fish markets who in turn will sell to home consumers.

When should you put your product on the market? Van Housen advises aquaculturists to consider seasonal price fluctuations. As a general rule, when landings of striped bass are highest, the price will be low. Van Housen says farmers should look at

Continued on next page



Striped bass x white bass hybrid, top; striped bass, below

price fluctuations and harvest their ponds when striped bass are not as plentiful. Look for trends, he says, not day-to-day fluctuations.

Control over time of harvest also will allow you to choose where in the distribution channel you want to en-

ter. Generally, fishermen sell to packing houses, which sell to wholesalers, who can either sell to restaurants or retailers or to another wholesaler. At each step, the price of the fish goes up because of the profit margin of each of the participants.

But the fish farmer has more flexibility. He can enter the distribution channel further on and get more money for his product.

Another advantage is that the farmer has control over the size of fish he harvests. This can be crucial since there are definite preferences for sizes within the mid-Atlantic states. New York and New Jersey consumers, for example, prefer larger fish, from 2 to as much as 30 pounds. In North Carolina and Virginia markets, consumers prefer smaller 1- to 4-pound fish. If larger fish demand a higher price per pound, weigh that against the cost of holding the fish until they reach the larger size.

To promote your product, research and analyze the market to determine which segment you want to sell to. Then, go to that segment and emphasize the advantages of a hybrid. For example, suppose you want to sell to restaurants. Tell the restaurateur that you can control the size of the product, when he can get it and what form it will be in.

For more information about aquaculture, contact Hodson at 919/737-2454 or Rouse at 919/322-4054.

—Nancy Davis

A place in the sun

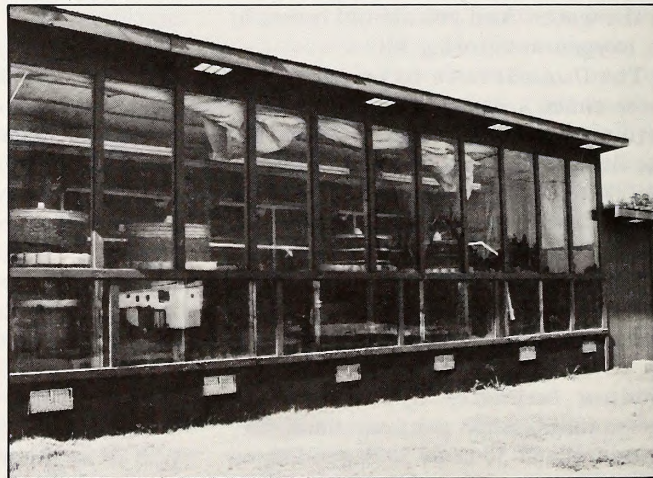
North Carolina has numerous sites where aquatic farms could locate and several species suitable for culturing. But with a growing season of only seven to eight months in outdoor pools and ponds, aquaculturists are faced with the possibility of shutting down during the winter months. Moving culture operations inside is one solution but the cost of heating large volumes of water is generally prohibitive.

The solution? A solar-powered greenhouse.

In 1984, UNC Sea Grant Associate Director Ron Hodson and marine advisory agent Randy Rouse tested the feasibility of raising fish year-round. They constructed a passive solar greenhouse that would store the heat it collected during the day. Water serves as the main heat sink, and a recirculating system maintains water quality and reduces heat loss.

In January, Mother Nature put the greenhouse through its toughest test so far. Temperatures outside Sea Grant's Aquaculture Center in Aurora plunged below zero. But in tanks inside the greenhouse, striped bass hybrids swam in 70-degree water temperatures. Even when the weather was harsh on plants and animals outdoors, fish inside fared well.

Photo by Doug Yoder



Sea Grant's passive solar greenhouse

Hodson estimates the greenhouse cost \$5,000 to build and \$5,000 to equip as a culture facility for larvae and fingerlings.

If you'd like to take a look at the greenhouse, contact Rouse at 919/322-4054.

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What fish is most like the soybean? For UNC Sea Grant researcher Tyre Lanier, the answer is menhaden. In fact, Lanier thinks the similarities are so strong that he nicknamed the fatty, oily fish "the soybean of the sea."

At the turn of the century, he explains, soybean research resulted in edible oils and protein concentrates. Now, one or both of those ingredients can be found in almost every domestically manufactured food product.

In a recent Sea Grant publication, *Menhaden: Soybean of the Sea*, Lanier predicts a similar outcome for the currently underutilized menhaden. Although the menhaden fishery is the nation's largest in terms of volume, its value per pound ranks well below other species. The reasons are simple: the menhaden has always been an industrial fish. Until now, it has been used for fertilizer and for chicken feed, but it's never made it to the dinner table.

Lanier's research brings menhaden one step closer to our menus. In his 24-page booklet, Lanier describes his research aimed at using menhaden to make surimi—a minced fish product developed by the Japanese. By water washing the mince, they end up with a protein concentrate suitable for use in restructured seafood products such as shrimp, scallops and crab legs. The natural counterparts of these foods are high in demand and in price. But the

restructured product is low in cost and high in food value.

For a copy of Lanier's booklet, write UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Ask for publication UNC-SG-85-02. The cost is \$3.

Drinking and driving don't mix—on the road or on the water. The sun, sea and suds can be a deadly combination for boaters. More than half of the boating fatalities that occur each year are alcohol-related.

Accidents can happen in any kind of vessel if boaters are intoxicated. Alcohol dulls the senses, impairs balance and doubles reaction time. Overexposure to the sun, wind, motion and glare can have a similar effect. Together, the two decrease a boater's ability to safely observe and react to conditions on the water.

This summer, be aware of these dangers. Don't drink and drive. Watch your speed, and stay alert.

For more tips on boating safety, write or call the local office of the Coast Guard Auxiliary, the U.S. Power Squadron or the Red Cross.



Catch some excitement this summer at the 1985 Marine Environment Workshop in Swansboro. July 22 to 26, youngsters ages 14 to 18 can take a ride on a trawler, snorkel in the ocean or study aquariums. These activities and others will teach participants about marine resources, ecology, marine problems and marine-related careers.

Set at Mitchell 4-H Camp on Queens Creek, instructors will use surrounding marine resources to conduct field investigations in marsh and beach habitats. The program is sponsored by the North Carolina 4-H organizations and UNC Sea Grant. Attendance is not limited to 4-H members.

Cost for the workshop is \$125. The fee includes meals, lodging, insurance, equipment fees and field trips. Participants must arrange their own trans-

portation to the camp, but names and addresses of others attending can be furnished for those who would like to arrange a carpool.

For an application, see your county 4-H agent or write Roland Flory at the N.C. 4-H Camping Office, Box 7606, N.C. State University, Raleigh, N.C. 27695-7606. Or call, 919/737-3242.



Sea Grant's winning style was recently recognized by the Society for Technical Communications in their annual publications competition. Three Sea

Grant publications received awards this year.

"North Carolina Seafood," a colorful poster showing the seasonality of 23 kinds of fish and shellfish, won an award of excellence in the regional competition sponsored by the Carolina Chapter of the STC. From there, the poster went to the International Technical Art competition where it won an award of achievement. Joyce Taylor, Sea Grant's seafood agent at the N.C. State University Seafood Laboratory in Morehead City, created the concept for the poster. Graphic designer Ginny Petty illustrated the poster.

In the STC's regional technical publications competition, "Coastwatch" received an award of merit. The newsletter is edited by Kathy Hart; Nancy Davis and Sarah Friday are staff writers.

"Opening a Bed and Breakfast," a brochure providing guidelines for homeowners who are considering opening such an establishment, won an achievement award. It was written by Rich Novak, a Sea Grant regional marine specialist, and edited by Kathy Hart.

Mark your calendar for the Crystal Coast Saltwater Sportfishing Show August 10 and 11 in Morehead City. Anglers can take a day off from the water and see the latest in recreational

Continued on next page

boats, tackle, motors, trailers and other fishing equipment. In addition, seminars and workshops related to recreational fishing will be offered on topics such as bait-rigging, surf fishing and flounder fishing.

This free, public event will be held at the National Guard Armory off U.S. 70. It is sponsored by the Crystal Coast Charter Boat Association, the Carteret County Sportfishing Association and UNC Sea Grant. Some of the seminars will require pre-registration. Times for the show are: Saturday, 11 a.m. to 9 p.m., and Sunday, 11 a.m. to 5 p.m.

For more information, call Sea Grant marine advisory agent Bob Hines at 919/247-4007.

The N.C. Marine Resources Centers have a summer program for you. Seafood programs, film series, sea-shore workshops, field trips and special programs for children . . . just to name a few.

Located at Roanoke Island, Bogue Banks and Fort Fisher, the facilities house public aquaria, exhibits,

laboratories and more. UNC Sea Grant Marine Advisory Service offices also are located at the centers.

For a calendar of the summer's events, contact the centers at: Roanoke Island, Box 967, Manteo, N.C. 27954; Bogue Banks, Atlantic Beach, N.C. 28512; and Fort Fisher, P. O. Box 130, Kure Beach, N.C. 28449.



There're more fish in the sea to catch than flounder, snapper and red drum. Other species normally shunned like triggerfish, skate and shark can be good targets, too.

That's the message behind a new Sea Grant slide/tape show on underutilized fish. The 21-minute show discusses the findings of a National Marine Fisheries Service study of underutilized recreational species in Southeastern waters. Its purpose is to dispel common misconceptions about 20 underutilized species.

The program also gives tips on

fishing for underutilized species, and tells how to prepare them.

Anthropologists Jeff Johnson and David Griffith of East Carolina University, and Jim Murray, Sea Grant's Marine Advisory Service director, conducted the study. Their slide/tape show is available for loan to sportfishing clubs. Upon request, Murray will show the slides and tell club members about the project.

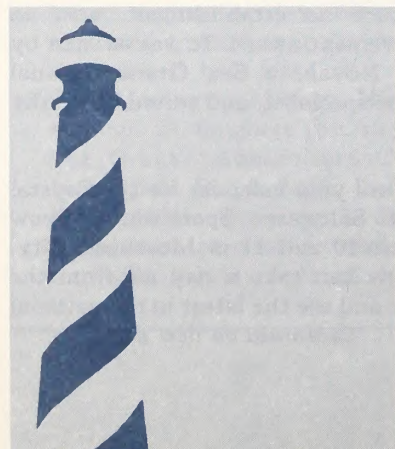
For more information about the show, write Murray at UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605. Or call 919/737-2454.

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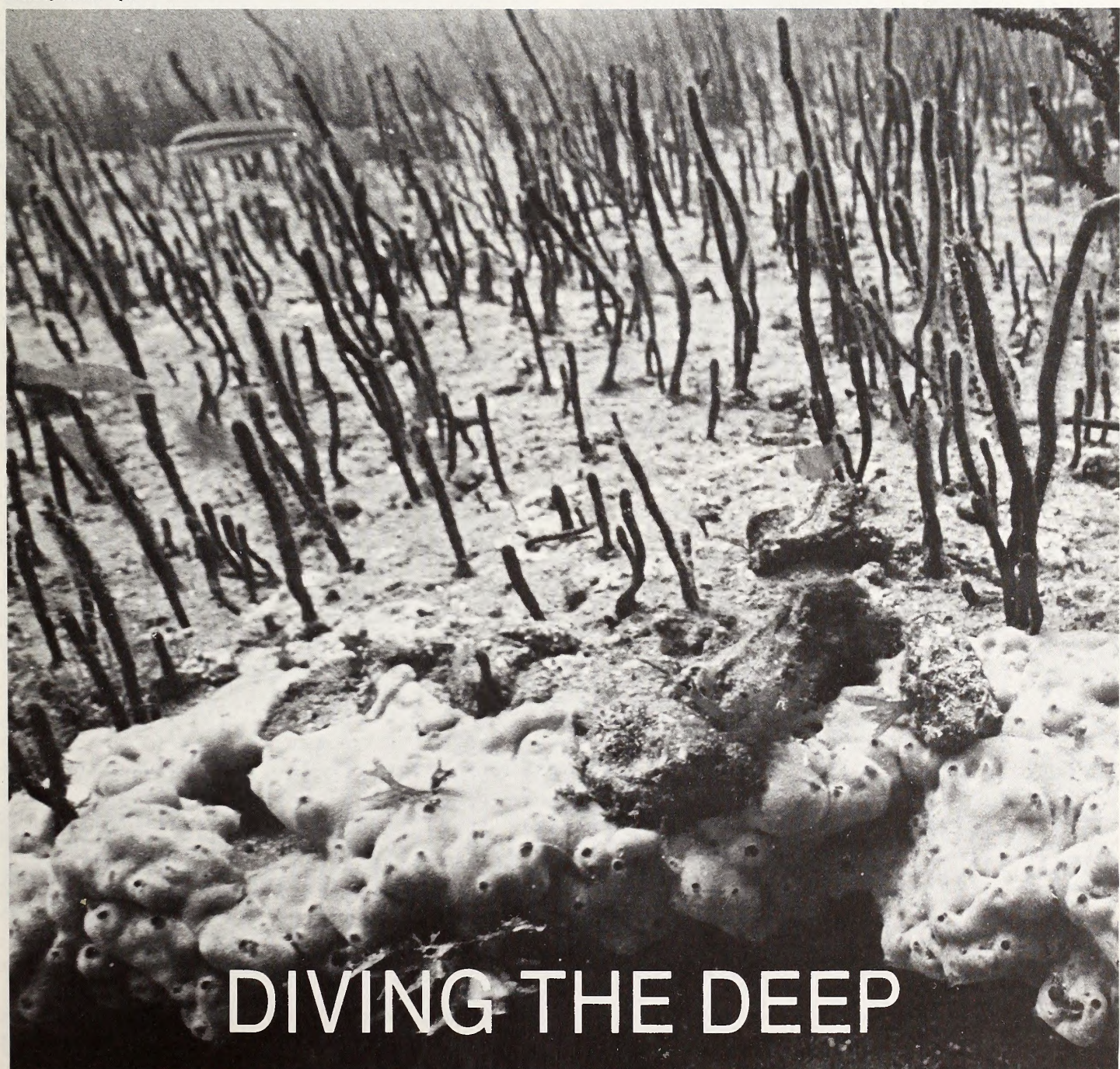
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COAST WATCH

Photo by Mark Hooper



DIVING THE DEEP



TAKING THE PLUNGE

Amberjack, barracuda, spottail and cod are a few of the warm- and cold-water species of fish found around the reefs and wrecks off the Tar Heel coast.

For those who scuba dive, there's nothing like it. The weightless feeling. The beauty of the unfamiliar. The sense of adventure. It's all there for those who sink into this final frontier.

Bob Eastep, a dive instructor and dive boat captain with EJW Sport Shop in Morehead City, says diving is on the increase in North Carolina. "It used to be that I had the only charter boat in this area that strictly took out divers," Eastep says. "Now there are 10 dive charters in the Beaufort-Morehead City area."

It's not just North Carolina divers who are flocking to our coast. Eastep says divers from Virginia, New York, Florida, Maine, Alaska and even Germany have chartered his boat.

What attracts these undersea enthusiasts? For the most part, it's the hundreds of wrecks that litter the state's continental shelf. They range from Civil War blockade runners to German U-boats (see story, page 5).

But the wrecks provide more than a history lesson or the lure of artifacts. They're a study in underwater biology. The wrecks become encrusted with barnacles and corals that attract baitfish, which in turn attract larger fish. The diver might see amberjacks, barracudas, triggerfish, groupers, filefish or spottails, says Jim Murray, president of the N.C. Wreck Divers Association and the director of Sea Grant's Marine Advisory Service.

North Carolina's offshore waters house species of a warm and cold nature. The cold-water Labrador currents and the warm-water Gulf Stream meet along the coast, attracting species from opposite climates.

Eastep, who has been diving since 1957, says most divers see a wreck once or twice and don't want to go back again. "I've been on some wrecks 70 or 80 times," he says. "And I always see something different."

"I've seen a cobia following closely behind a ray, picking up the crabs the ray stirs up as it flaps its wings," he says. "Near the Gulf Stream, I saw a couple of whales. And a shark is a majestic thing to see underwater." Eastep enjoys watching the interactions between fish, examining the colorful corals and collecting shells.

For a more natural setting, divers can locate one of the state's natural reefs. "I'm trying to convince more divers to try the natural reefs," Eastep says. "They're not overpopulated with divers like many of the wrecks."

Murray agrees that the natural reefs are a favorable alternative to wreck diving. "You get the feeling that you are the first one to dive there," he says. In addi-

tion to a variety of fish, Murray says the reefs offer interesting flora.

But whether it's reef or wreck, John G. Stewart, an assistant professor of physical education and a diving instructor at N. C. State University, cautions that diving offshore can be rough. Typically seas off the North Carolina coast run one to three feet. Anything rougher can cause problems for the diver — reduced visibility underwater, stronger near-surface currents, greater likelihood of seasickness, difficulty in boarding a bobbing boat. Stewart and Eastep say that only experienced ocean divers should dive in rough seas.

Although some hazards do threaten the safety of scuba divers, others have been overdramatized. Movies such as "Jaws" and "The Deep" play up the ferocity of underwater creatures such as sharks, barracudas and eels. But Eastep and Stewart say these movies exaggerate the danger from such creatures. The rule of thumb: You leave the creatures alone, and they'll leave you alone.

Although diving seems to be an enticing sport,

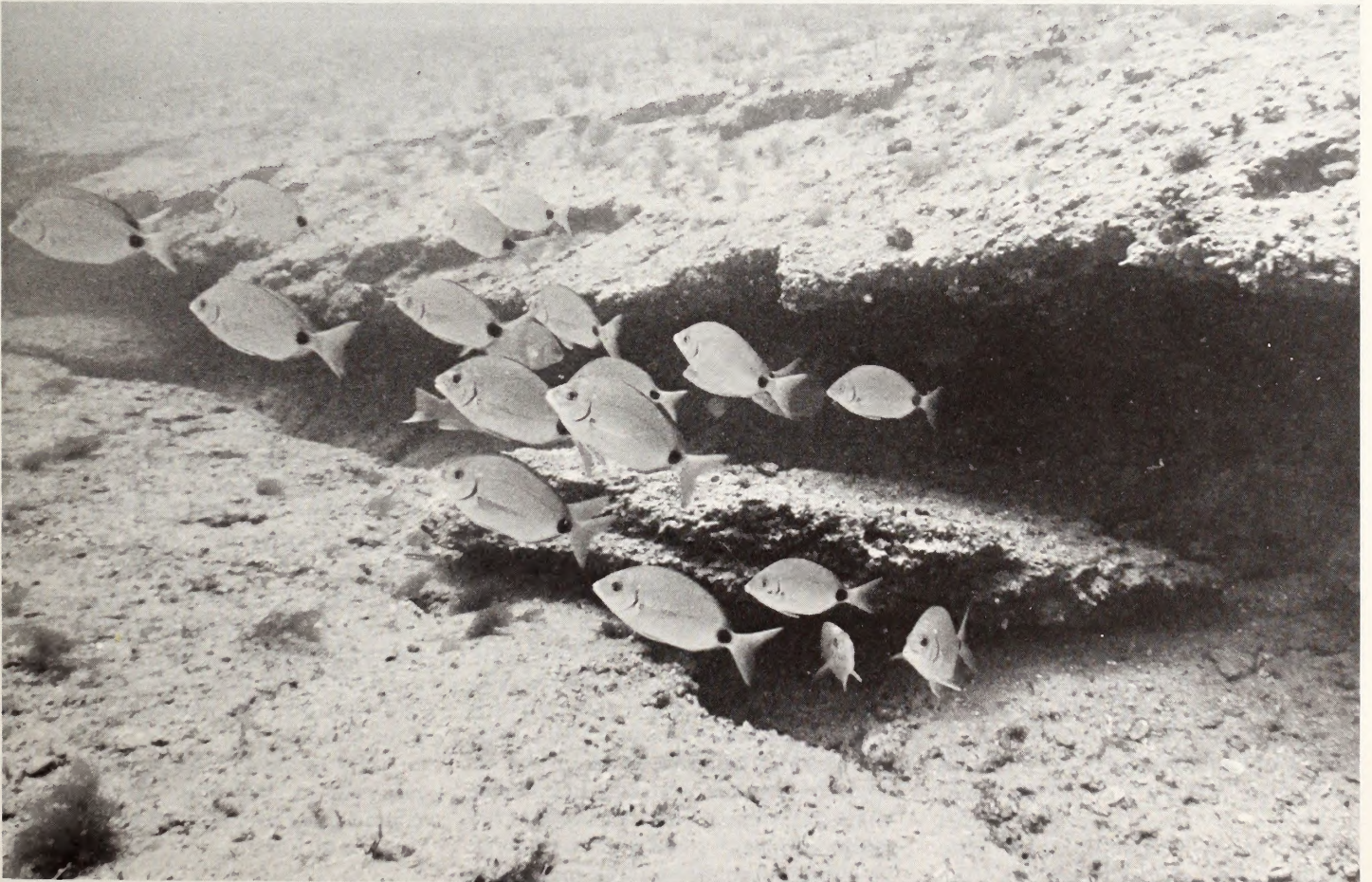
many people abandon its ranks after their instruction or after only a few dives. Of the 250,000 people certified for scuba diving nationwide each year, Stewart says only 10 percent continue to dive regularly. As reasons for the high dropout rate, he cites the cost of equipment (from \$700 to \$1,500), the lack of good diving sites, an unfavorable initial open-water experience and the lack of diving companions.

In a 1984 survey of subscribers, *Skin Diver* magazine found that divers are most often male (86.9 percent), between the ages of 25 and 39 (60.8 percent), have an average household income of \$43,000, and attended or are attending college (80.8 percent).

The average *Skin Diver* subscriber has been interested in diving more than 10 years and has been diving for six and a half years. Almost one-fifth of the respondents are members of organized dive clubs. And most divers have auxiliary interests or hobbies such as wreck diving, cave diving, underwater photography, shell collecting and spearfishing.

— Kathy Hart

Photo by Mark Hooper



A school of spottail pinfish swim near a natural underwater reef

Once you slip beneath the waves you're out of your element. Instead of being surrounded by oceans of air, you're immersed in a sea of water. Your lifeline of air is pumped from a tank strapped to your back. Your life depends on you.

John G. Stewart says scuba diving is as safe as any other sport if you receive the proper training, observe the correct safety procedures and know your physical limitations.

Before giving the sport a plunge, enroll in a good certification program, Stewart says. The National Association of Underwater Instructors (NAUI), The Professional Association of Diving Instructors (PADI), the YMCA, the National Association of Skin Diving Schools (NASDA), and others offer instructional certification programs.

Check with your local dive shop, YMCA or college or university to see which certification programs are offered in your area. The various programs require students to meet virtually the same certification standards.

Stewart says students entering his course should be good swimmers. In addition to having completed a skin diving course (which is different from scuba diving because it requires only a mask, snorkel and fins), students must be able to swim 400 yards, swim underwater 20 yards, tow a passive victim 50 yards, tread water 15 minutes and retrieve an object from the bottom of the pool, he says.

Courses require classroom teaching and pool and open-water experience. Upon completion, students receive a certification card that will allow them to purchase air, rent equipment and charter dive boats. Although no state or federal law requires certification, dive shop owners and boat captains regulate the sport themselves to ensure safety and negate their liability in case of an accident.

Stewart advises beginning scuba enthusiasts to limit their initial dives to 60 feet or less. At deeper depths, divers must contend with the possibility of nitrogen narcosis (the narcotic effect that overcomes divers



DIVING SAFETY

An ounce of precaution

at deep depths, impairing their judgment) and decompression sickness. Commonly called "the bends," decompression sickness occurs when a diver surfaces too quickly from a long or deep dive, not allowing enough time to adequately release nitrogen through normal respiration. Bubbles of gas are released in the tissue and bloodstream, causing pain. The cure? Recompression at a hyperbaric chamber.

"Besides, I tell them at shallower depths, you have more light penetration and better colors," he says. "You can make longer dives, and you don't have to worry about nitrogen narcosis or decompression sickness."

Bob Eastep says the charter dive boats in Carteret County will refuse to take divers to wrecks or reefs over 80 feet deep until they have made five shallow-water dives. "We had people making their first dives on the U-352 (the wreck of a German submarine that sits about 120 feet below the ocean surface)," he says. "That wreck is entirely too deep for a beginning diver."

Stewart says diving accidents are caused when divers don't realize their limitations. "Drowning is the leading cause of death in diving," he says. "And most drowning accidents occur because people overestimate their capabilities. Of the diver, the equipment and the environment, the diver himself is the most hazardous."

Panic can be a diver's number one enemy underwater, Stewart warns. It can cause problems such as air embolism. Air embolism occurs when a diver holds his breath on ascent and doesn't exhale the gases that expand as the pressure on the body decreases. Unreleased gases can rupture the lungs, sending bubbles into the bloodstream. Since the bubbles tend to travel upward, they become lodged in the brain, cutting off circulation. Brain damage or death can occur in minutes.

Although air embolism and decompression sickness are problems that could happen, they rarely do happen, Stewart says. A properly trained diver should know how to handle emergency situations.

Other diving precautions that can prevent accidents include:

- * Raise the divers' flag. It will warn other boaters that divers are in the surrounding waters.

- * Never dive alone. Dive with someone whose capabilities you know and trust, and always stay within sight of your companion underwater.

- * Use the U.S. Navy dive tables conservatively when planning your dives. Long or deep dives usually require decompression stops before surfacing.

- * Use the U.S. Navy repetitive dive tables for any dive made within 10 minutes to 12 hours of a previous dive.

- * Never dive after drinking or taking drugs. They can impair your judgment underwater.

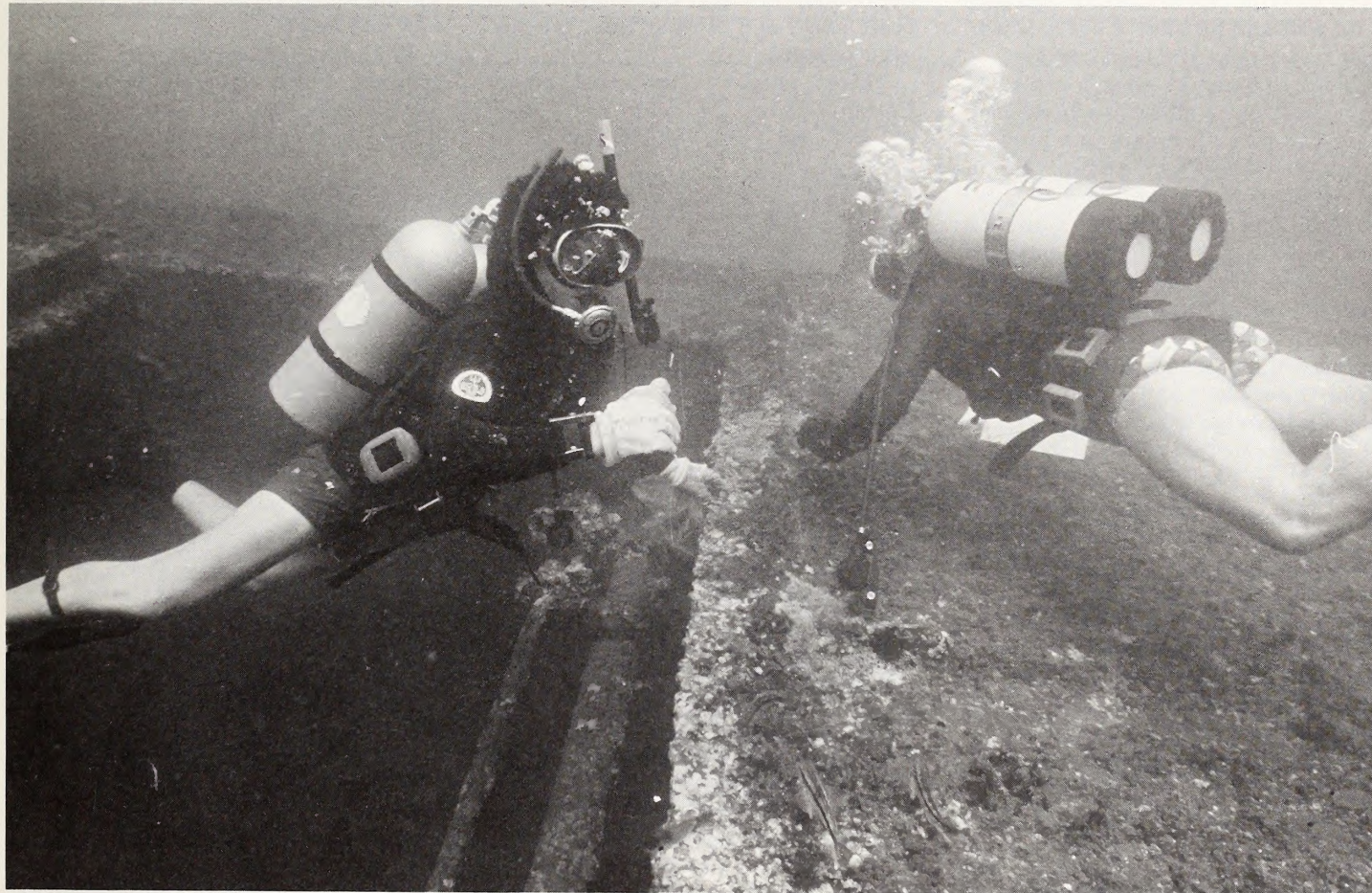
- * Don't dive if you have a cold. You can rupture your eardrums or injure your sinuses.

- * If you haven't been diving in the last four to six months, go through a conditioning program before donning a mask and fins.

— Kathy Hart

WRECK DIVING IN NORTH CAROLINA

Photo by Mark Hooper



From blockade runners to schooners to submarines, the ocean off the North Carolina coast is strewn with the remains of thousands of wrecks.

BY SARAH FRIDAY

Just a few miles off North Carolina's coast lies an underwater museum filled with history, mystery and enchantment. The sunken ships of the Graveyard of the Atlantic comprise a collection that's intriguing to a different kind of tourist. Fish and fishermen flock to these artificial reefs in search of meals. For a closer look, it's scuba divers who have the advantage.

Thousands of old crafts rest between Currituck and Calabash, making North Carolina a wreck diver's paradise. Only a few hundred ships have actually been located, however. Of these, about 100 are at divable depths, says Rod Farb, diver and author of *Shipwrecks: Diving the Graveyard of the Atlantic*. The wrecks lie from near shore to 60 miles offshore in water 30 to 160 feet deep.

The number and variety of wrecks in North Carolina lure novice and expert divers from around the world.

Along the ocean floor are submarines, schooners, steamers, gunboats, blockade runners, barges, tugs, freighters and other boats up to four centuries old. Most of them sank when snagged on a series of shoals jutting from the capes and inlets of the Outer Banks. Others went down when they met another ship, dangerous currents, bad storms or hurricanes.

To no surprise, these vessels are in all states of disarray, says Farb. The *John D. Gill*, a World War II tanker off Wrightsville Beach, sits straight up. Other wrecks are upside down or on their sides. And most have disintegrated in the middle with the bow and stern left intact.

With such a unique collection of exhibits, the Graveyard of the Atlantic offers something for every kind of diver.

History buffs can explore Civil War blockade runners or a submarine like

Continued on next page

the *U-352*, the first German U-boat sunk by the Coast Guard during World War II. Farb says the sub off Morehead City is probably the wreck dived most in North Carolina because of its past and because it lies in warm, clear water near the Gulf Stream.

Divers looking to spot a school of amberjack or to photograph delicate corals can take the plunge on a number of inshore or offshore wrecks. One of the most colorful is the 528-foot *John D. Gill*, says Jim Murray. Since the *Gill* sank in 1942, it has collected corals, sponges, sea fans and other oceanic plants. Angelfish, barracudas, eels and a host of different marine species are prevalent, too.

For those who want a souvenir from their underwater trip, most wrecks offer a treasure chest of goods. "There's always a chance you'll find something," says Murray. "When you get to the more intact ones, you can poke around inside and see what's in there."

Portholes, artillery, coins, tableware and stained glass windows are popular takes. But brass is the number one find, says Linda Purifoy of Olympus Dive Charter in Morehead City. Her husband, George, brought home an 800-pound solid brass table from one of his dives. And he's collected other brass artifacts such as fittings, kitchen utensils and a large clock from the *USS Schurtz*, an oceanliner that sank in 1918.

Not everything is for the taking, however. Salvaging is prohibited on wrecks that lie within three miles of the coast unless a permit is obtained from the Underwater Archaeology Branch of the N.C. Department of Cultural Resources. Any historic artifacts found must be returned to the state.

Beyond the state's jurisdiction, diving and salvaging is permitted on all wrecks except those designated as National Marine Sanctuaries. The *USS Monitor* off Cape Hatteras falls under this category. The *Monitor* sank offshore during a storm, only months after battling the *Merrimack* in the world's first clash of ironclad ships during the Civil War.

Another ship, the *USS Peterhoff*, comes under federal jurisdiction and is listed in the National Register of Historic Places. Divers must obtain a permit from the U.S. Navy to remove artifacts from it.

Most wreck diving takes place off the southern coast around Morehead City and Wrightsville Beach, says Ron Thrower, owner of Reef and Ridge Sport Shop in Cary. But areas around Nags Head and Oregon Inlet are also very popular.

"Most people believe that North Carolina dives are cold, dark, deep dives," says Farb, "but many of the

Photo by Steve Murray



Divers leave surf after visiting a nearshore wreck

dives are like the Caribbean." The water temperature ranges from 65 to 80 F during the diving season, which usually runs from April to November.

During the season, a number of charter services run to wrecks off North Carolina's coast. At the Olympus Dive Charter, for example, a group of 10 can reserve a boat for \$500 a day. For 25 people, it's \$900.

Offshore trips start early. The boat usually leaves the dock around 6 a.m., and depending on the site of the wreck, the ride can be long. Captains locate wrecks by using Loran-C or coordinates from a chart or manual such as UNC Sea Grant's book, *Hangs and Obstructions to Trawl Fishing: Atlantic Coast of the United States*.

It's best to dive a wreck with a trained dive master or leader, says Farb. Diving with groups such as the Wreck Divers Association or a scuba club is also a good idea. In addition, wreck divers need to take special safety precautions. Before the trip

they must be in good physical condition, have experience and maintain their equipment. At the dive site, Farb recommends basic scuba safety such as having a buddy and keeping the dive flag displayed.

It's also necessary to carry a compass and a signaling device since wrecks tend to be disorienting. If divers plan to enter a wreck they

should use a lifeline to prevent getting lost. And because wrecks are often in deep water, additional tanks of oxygen are a good first aid measure.

For inshore dives, less travel time and expense are involved, says Murray. There is also a better chance of good weather. Because the water is shallow, divers can stay below longer.

The same is true for beach diving. Often, divers can swim to the site, eliminating the need for a boat. Diving during slack tide is best, says Farb, because currents and surges are less turbulent and visibility on the wreck may be better.

To Farb, diving wrecks anywhere in North Carolina is like running upon an underwater oasis. Miles of the ocean floor look like the desert, but here and there is a vessel that's definitely no mirage.

(The hang log book is available by writing UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605. Ask for publication number UNC-SG-83-01. The cost is \$2.)

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



During hurricane season, boaters need to be on their own kind of coast guard. From June until November, hurricanes can occur any time, tossing boats around marinas or out to sea. But boat damage can be minimal if operators take some precautionary measures before the skies blacken and the wind whips through the sails.

First, prepare a checklist of equipment needed to secure your boat. Assemble it and keep it together. Also, check your homeowner's insurance policy to see if it adequately covers storm damage to your boat and protects you if the boat gets loose and causes damage elsewhere.

On board, have enough line (about 200 feet) to tie your boat securely. Nylon line or spring lines are recommended. Use chafing gear on all lines to protect them from wear. Make sure the fenders are well secured to your boat to protect it from other boats, sea walls and other obstructions during a storm. Keep bilge pumps in top working order. Have radio equipment available for receiving weather information and for communications. Keep batteries fully charged; a spare battery on deck is a good idea. If possible, fuel tanks should be kept full during hurricane season.

The National Weather Service issues a warning 12 to 24 hours before a hurricane. Boat owners should act immediately upon a warning.

If conditions are safe, transport your

boat to a dry shelter. If you can't get to a shelter, pull your boat ashore and tie it to a large, strong tree with a good root system. When tying it, remember that the tide rises 10 to 20 feet above normal and wind directions change during a hurricane. Secure the boat for all directions.

If the boat must stay in the water, take all movable equipment off such as sails, radios and cushions. Latch down all you cannot move. And seal all openings to make it as watertight as possible.

If you are on the water when a warning is issued, immediately head for safe harbor. Don't stay with your boat; seek shelter on land.



The National Oceanic and Atmospheric Administration is taking applications for fisheries observers for the Foreign Fishing Vessel Observer Program. Fifteen to 25 positions are available each month for two- and three-month tours at sea. Observers live aboard foreign fishing vessels operating within the U.S. 200-mile fisheries conservation zone in North Pacific waters. Duties include collection and recording of biological and catch volume data.

Preference will be given to candidates with training in marine biology, fisheries biology, fisheries or related fields. For an application packet, write Robin Hill, Frank Orth and Associates Inc., Suite 517, 110 110th Avenue, N.E., Bellevue, Wash. 98004. Or, call 206/455-3507.

UNC Sea Grant will cosponsor an artificial reef conference Sept. 30 at the University of North Carolina at Wilmington. The conference will bring together university researchers, fisheries managers, public officials and fishermen to discuss the status of artificial reef development in the southeast. The conference is free and open to the public. Other sponsors include the UNC-W Department of Biological Sciences, the National

Oceanic and Atmospheric Administration's National Undersea Research Program—Southeast Region, and the Wrightsville Beach King Mackerel Tournament Committee. For more information, call Sea Grant Marine Advisory Service Director Jim Murray at 919/737-2454 or UNC-W marine biologist Dave Lindquist at 919/394-3474.



North Carolina fishermen who plan to harvest seafood other than oysters from the tidal waters of Virginia must apply for a license. If you plan to fish in Virginia waters during the 1986 calendar year, you must apply for a non-resident harvester's license and any other required licenses prior to Sept. 30, 1985.

For more information, contact the Virginia Marine Resources Commission, P.O. Box 756, 2401 West Avenue, Newport News, Va. 23601. Or call 804/247-2238.

Boating is big business in North Carolina. That's why Sea Grant and the N.C. Saltwater Fishing Federation are sponsoring a study to examine the economics of the state's recreational boating industry.

Using mini-grant funds, Sea Grant researcher Jeff Johnson, an anthropologist at East Carolina University, will compile information on the number of boating manufacturers, the people they employ, and the money the industry generates. His findings, along with data from an earlier Sea Grant study of North Carolina's recreational sound fishery, will provide a better picture of the overall impact of the sportfishing industry.

Bob Stryker, former president of the federation, says this study will provide information that sport fishermen can present to the legislature and to the fisheries commission to support the idea that the industry is large. In addi-

Continued on next page

tion, it may help support the contention that more funding is needed for recreational fisheries development and management.

Larry Cahoon, a biologist at the University of North Carolina at Wilmington, has been awarded a mini-grant to study the distribution of benthic microalgae on the outer continental shelf. Cahoon believes the algae may be important in the overall productivity of the continental shelf since it may provide an important food source for a variety of organisms.

Previously, scientists believed the waters of the continental shelf were too deep to allow penetration of enough light for algae to grow. But in preliminary work completed under another mini-grant, Cahoon found large populations of the microalgae.

Sea Grant researcher Hans Paerl will travel to Nairobi, Kenya, Sept. 30 to participate in a United Nations Educational, Scientific and Cultural Organization symposium on the comparative ecology of aquatic environ-

ments. Paerl will join scientists from other nations to discuss the characteristics and functioning of freshwater and coastal marine ecosystems.



The N.C. Department of Natural Resources and Community Development's Division of Environmental Management is holding a technical session and public hearing on special water quality criteria for primary nursery areas. The technical session is 10 a.m. to noon and 1 p.m. to 5 p.m. Sept. 16 at Carteret Technical College in Morehead City. A public hearing will follow at 7 p.m.

In the technical session, UNC Sea Grant Director B. J. Copeland and researchers Hans Paerl, Don Stanley, Wayne Skaggs, Wendell Gilliam, Len Pietrafesa and John Miller will present technical information they've obtained through their Sea Grant projects.

Public hearings will also be held in Wilmington on Sept. 17 at 7 p.m. at Cape Fear Technical Institute and in Washington, N.C., on Sept. 23 at 7

p.m. in the Beaufort County courthouse.

A summary of the proposed water quality criteria can be obtained by contacting the Division of Environmental Management at 919/733-5083.

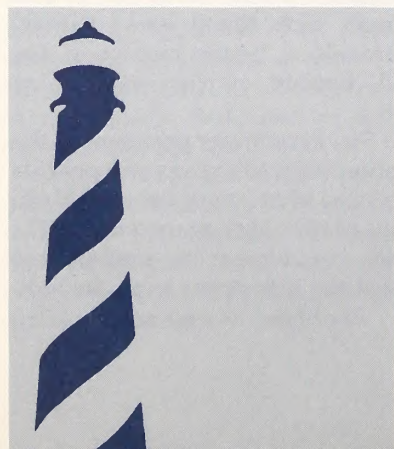
The UNC Sea Grant Program will be reviewed for recertification October 8-11 at the Carolina Inn in Chapel Hill. A team of scientists and administrators will review the program's progress, direction and impact on coastal North Carolina since its original certification as a college program in 1976.

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COAST WATCH

Photo by Scott Taylor



SEAFOOD S-A-V-V-Y

These days, dealers know more than fish. They're talking marketing strategy and watching supply and demand curves.

Four days of fishing at sea, and the crew and its catch finally reach the dock. For the fishermen, the work is over for now. For the fish, the journey has just begun.

What happens from the time that delectable seafood is swimming in the Atlantic to the time it graces your dinner table? A simplified itinerary might include stops at a packing house, a wholesaler, a retailer and finally, your table. Whatever the path, the chain of events is all part of the seafood industry.

By most indications, it's an industry on the rise. In 1965, the dockside value of North Carolina's commercial fisheries was estimated at \$9.2 million. In 1984, fishermen landed over 277 million pounds of fish and shellfish for a dockside value of \$57.3 million; the majority of those species were classified as seafood. Nationally, the seafood industry is worth a whopping \$2.4 billion.

One of the reasons for the industry's growth is the rising popularity of seafood. Last year Americans ate more fish and shellfish than ever before. Per capita consumption of seafood reached 13.6 pounds. We still have a long way to go before we catch up with countries like Japan where residents consume nearly 150 pounds of seafood each year, but with the current focus on healthful eating habits, experts say the trend will continue.

Sea Grant extension specialist Frank Thomas, a food scientist at N.C. State University, has observed the seafood industry in the state over the last 20 years. He says, "The interest in seafood is up several hundred fold. The nutritional consciousness we have now and the studies that support seafood consumption have boosted the industry tremendously. Twenty years ago, we harvested 55 species of fish and shellfish. Now, we're using 75 or 80 of our species. We're utilizing more of the resource today."

Along with the expanded industry has come an increased sophistication. Small fish houses still outnumber

Photo by Scott Taylor



Atlantic Beach shrimpers show off their catch

ber the large, but their owners know more than just fish. These days, talk of marketing strategy, supply and demand curves, and import quotas is likely to float over the seafood counter.

Even so, the seafood dealer still has to deal with the vagaries of the business: erratic supply, constantly fluctuating prices, and a market characterized by speculation and stiff competition.

The level of competition has prompted some in the business to label it "the last vestige of free enterprise." They say it's a business that's easy to get into, but hard to stay in.

The seafood consumer also has come of age. He wants to know more about the seafood he buys—where it came from, how fresh it is and why it costs what it does.

The marketing process holds the answers to all his questions. It actually begins when the fisherman leaves the dock. Ideally, he'll be in touch with the packing house while he's at sea. He radios ashore to let the packing house know what species and how much to expect.

In the meantime, the seafood dealer at the packing house is investigating the market, finding out how much of the species is already available and what it's selling for. With this information, he can determine

how much to pay the fisherman for his catch.

"You have to know what you can sell it for before you can figure out how much you can buy it for," says Jim Howell, manager of Clark's Seafood in Beaufort.

Doug Brady, vice president of Meridian Seafood that includes Ottis' Fish Market in Morehead City, spends most of each day on the telephone, calling up and down the East Coast to investigate the market. He knows that what's happening in states like New York and Maryland has an impact on the market in this state.

The fisherman docks his boat and unloads his catch by the basketful. There, the fish may be culled, sized and "cut"—processed by heading, gutting or filleting.

From here, the road from catch to consumption becomes less well-marked. Howell describes the various routes a fish might take: "A fish could go from the packing house to a retail market and then to the public. Or it could go from a packing house to a processor and from there to a retail market. Or it could go from a packing house to a processor to another processor and then finally to the public." Such is the complexity of the seafood market.

At each step in the marketing chain, the price goes up because each handler has to make a profit for himself. And everybody wants to make 20 to 30 cents per pound on the fish he handles, says Howell. But he adds that the price isn't arbitrary. "There's a market price out there. You can't just keep adding 10 cents to the price."

Most of Howell's sales are at the wholesale level. He says a wholesale price is really a discount price. "We're giving them a better price if they'll buy a bulk amount."

Howell establishes three price levels for his wholesale customers and charges them according to how far he has to ship the product, how much the customer buys, and how good a customer it is. Retail prices are generally higher because tax is added and because the product has been through more steps in the marketing process.

Nature often adds a little extra uncertainty when it comes to pricing seafood. Occasional gluts of a species can drive the price down since only a limited amount of fresh fish can be used at any given time. On the other hand, scarceness of a species can force a dealer to buy out of state to fill demand.

"A lot of dealing with fish is speculation," says Howell. "You play the seasons. In a glut, you put some fish in the freezer and hold it."

In the winter, for example, when finfish are plentiful, dealers often freeze a lot of species such as flounder, croaker and trout.

When supplies of a particular species are plentiful in this state and the price begins to drop, a dealer might ship his product to northern markets such as New York, Boston, Philadelphia or Baltimore.

The Fulton Fish Market in New York is the largest

seafood wholesaler in the country. Fulton information officer Richard Lord says the market deals with an average half million pounds of seafood each day and about 140 million pounds per year. In October 1984, the market sold over a million pounds in one day.

The sheer size of the Fulton Fish Market has resulted in the notion that it controls seafood prices along the East Coast. But Gary Van Housen, Sea Grant's seafood marketing specialist, says supply and demand control the price of seafood, and Fulton just mirrors supply and demand. Therefore, when prices increase dramatically, it probably indicates a tighter supply. If the price drops suddenly, it could mean there is a surplus supply.

Because of the seasonal nature of most species and the fact that seafood is a perishable item, seafood prices are always volatile, says Lord. "Whiting, for example, can go from 10 cents a pound to \$1.25 a pound over the year."

In the past year, Lord has seen an increased interest in seafood. But in order for that interest to continue to grow, there must be more attention paid to quality, he says. "I still see a lot of horrible stuff sold. Unless every step in the chain takes care of the catch, it hurts the whole business. Fish has so many benefits. And humans have an innate sense of what is good to eat. People eat things that taste good, and fish only tastes good when it's fresh."

Brady is more optimistic about the market here. "The thing that will help in this state is that fresh seafood, from a consumer's standpoint, is finally coming of age. As that happens, the market will increase."

—Nancy Davis

Photo by Scott Taylor



One of the first steps in the marketing chain

North Carolina Gives Seafood a Promotion

With new marketing efforts, consumers are taking a bigger bite out of the state's fish and shellfish.

Photo by Scott Taylor



Fresh North Carolina seafood on its way to the market

Carol Stigelman threw another plump, peeled shrimp into the colander, checking to see if she had enough for her sushi workshop that afternoon. As seafood development specialist for the N.C. Division of Marine Fisheries, Stigelman cooks up business for the state's seafood industry almost as easily as she cooks a pot of shrimp. She's a salesman of sorts, marketing what North Carolina's fishermen bring to shore.

Last year, the state's commercial fishermen pulled in more than 277 million pounds of fish with a dockside value of about \$57 million. Their nets lay full of menhaden, shrimp, crab, croaker, flounder and many other species. Some of the fish were processed for meal or oils, but the majority of the species eventually found their way to the table.

In cooking terms, North Carolina's seafood industry is rapidly coming to a boil. Marketing has helped heat the pan. Although different in focus, the seafood development programs of the Division of Marine Fisheries and Sea Grant share the same goal of increasing consumption of fish and shellfish from the coast.

Stigelman promotes the product among consumers and retailers, while Sea Grant agents Joyce Taylor and Gary Van Housen take an educational approach to marketing. As the Marine Advisory Service seafood agent, Taylor shares tips on handling and preparing seafoods with the public. Van Housen, Sea Grant's seafood marketing specialist, works with fishermen and processors and advocates quality. Together, they cover the market, spreading the word on seafood.



Carol Stigelman

"North Carolina has such a variety," says Stigelman. "We are untapped to the limits we can go to promote it. We have a year-round source of seafood. There's very little time boats cannot go out and bring something back."

Having such an assortment of goods enhances the state's marketing efforts. And recently, increased consumer interest in seafood has been a boon to the industry.

"There's a national trend to buy seafood—a national trend for healthful foods," says Van Housen. "People in North Carolina are becoming more aware, as evidenced by fish markets being put in supermarkets. This gives us a responsibility to make sure we present seafood to the consumer in the best manner possible."

Teaching people about quality fish is Van Housen's key to promoting the state's seafood. "I believe that by increasing the quality of the seafood presented to the consumer, you're going to increase their desire to buy seafood," he says. "Once the retailer knows what good quality fish is, we hope he'll pay a higher price." This, in turn, should give the fisherman, the packing house and the wholesaler the incentive to take the extra care required to obtain high quality fish.

Taylor agrees that education and

marketing go hand in hand. "As you educate people about ways to use seafood, that in itself sells more. A lot of people don't buy seafood because they don't know what to do with it when they get it home."

She and Stigelman often answer requests for information and send out recipes that pass their kitchen tests. Since fish is nutritious and generally low in calories, consumers are more anxious to try it in new dishes, says Stigelman.

"The more people know about the different varieties of fish in North Carolina, the more they will be willing to try them," says Van Housen. "I try to promote seafoods that people aren't currently familiar with," like soft shell crab and squid. "I also try to promote local seafood caught in North Carolina such as bay scallops."

A typical day for Van Housen might include anything from explaining the characteristics of a fresh fish to a Raleigh restaurant owner to discussing onboard handling techniques with a fisherman. He also gives seminars and slide shows, talks to seafood buyers at supermarkets and restaurants, sets up displays at trade shows and works one-to-one with fishermen and retailers.

Buyers at retail fish markets often ask Van Housen's advice on purchasing fresh fish, where they can get quality fish and who are reliable dealers on the coast.

On the other side of the docks, Van Housen helps fishermen find markets for extra fish. He can put fishermen in touch with wholesalers other than the traditional ones in the North. Too, there seems to be a trend for fishermen to market their fish directly, says Van Housen. They come to him wanting to know shipping and packaging costs and the best handling techniques.

He and Stigelman frequently help fishermen truck, air freight or export their catches. (Van Housen has recently written a Blueprint, "Air Freighting Seafood from Coastal North Carolina," which is available from Sea Grant.) In addition, they often emphasize quality control to buyers and handlers of seafood.

Stigelman's methods of marketing are as numerous as the kinds of fish she promotes. Much of her time is spent traveling to supermarkets or meeting grounds to tell people what seafood is available and how it can be prepared. Six to eight times a year she goes to

out-of-state trade shows as part of the Gulf and South Atlantic Fisheries Development Foundation to show off the state's catches to restaurateurs, seafood buyers and distributors.

Stigelman also works with the media, letting them know what seafoods are in season and which are good buys. This fall, she'll start a cable television show in Morehead City.

As Stigelman knows, selling folks on North Carolina's seafood can sometimes only take a bite. But marketing often becomes more complex, says Joe McClees, seafood development coordinator of the Division of Marine Fisheries. It involves helping people who make their living in the seafood industry. McClees and his staff, including Stigelman, help people build seafood businesses, finance or refinance boats or fishing operations, find distributors for surplus catches or do almost anything associated with the industry. In the long run, says McClees, their efforts build credibility and enhance the state's seafood market.

Until consumers eat more of our clams, crab and croaker, North Carolina's seafood marketing specialists won't be content to watch the industry simmer.

—Sarah Friday



Gary Van Housen

Fresh fish:

Photo by Scott Taylor



Proper handling ensures high quality fish

To some people, buying fresh fish is like buying a car. If it looks good on the outside, they'll take it. But with fish, it's just as important to check under the gills as it is to check under the hood before making a choice.

High quality and freshness is essential in the fishing industry and depends on everyone from the fisherman to the retailer. Extra care in handling means a better product for consumers, says Gary Van Housen, UNC Sea Grant's seafood marketing specialist. And when consumers are satisfied, they'll come back for more.

It's difficult to generalize how quality can be maintained in fish because of the variety of species, says Van Housen. Before joining Sea Grant, Van Housen served as a seafood inspection agent for the National Marine Fisheries Service in New York. He tested domestic and export products for quality, condition, weights and counts and worked with wholesalers in the U.S. Grade A program for seafood. In addition, he served as a consultant to fish processing plants, giving tips on overall plant sanitation and making sure machinery, processing techniques and procedures were up to government standards.

Now Van Housen uses his expertise to advise fishermen, processors, retailers and restaurant owners in North Carolina on ways to improve their handling of fresh fish. To ensure high quality trawl-caught finfish such as gray sea trout or flounder, Van Housen suggests the following techniques for fishermen.

Rinse the fish after they are hauled onto the boat, and before storage, cull the catch according to size. Then the fish should be iced down and placed in an insulated hold. Alternate layers of ice and fish should be stacked to a height no greater than three feet. This prevents weight loss and crushing of the fish on the bottom of the pile.

Fish should be stored at a temperature no greater than 33 F. Higher temperatures hasten deterioration, Van Housen says. If the proper temperature is maintained, fish can remain in top quality even after eight to 10 days on the boat. Poorly handled fish, however, may be in good condition for only three or four days.

Ice is a costly expense for fishermen, but Van Housen recommends its generous use. The amount of ice varies according to the time of year, what kind of catch is expected and how much insulation is provided. Flaked ice is better for the fish, says Van Housen, because it doesn't puncture them or scrape their skin as much as crushed ice. Crushed ice lasts longer, however.

Proper handling techniques at the processing plant also ensure a good quality product, says Van Housen. Because fish is highly perishable, remove fish from the

boat as quickly as possible. Rinse them in a wash tank or with a spray wash. Then sort fish by species and size and place them in waxed boxes filled with ice.

In general, most fish from North Carolina waters are shipped "in the round," or whole, to a wholesaler who may process or rebox the product. However, some dealers in the state do head and gut or fillet the fish before shipment.

Fresh finfish that go directly to a fish market or supermarket should be high in quality. It is important for consumers to take care in selecting fish, as, in general, it is not inspected like other meats. Congress is considering implementing a nationwide seafood inspection program, says Van Housen, but so far, the costs have been prohibitive.

A few items Van Housen suggests checking are the gills, eyes, skin, meat and odor. The gills should be bright red rather than dull pink. Eyes should be clear and bright, not dull and sunken. The fish's skin should be shiny, and the meat, firm and elastic. And its odor should be fresh and mild, similar to fresh seaweed.

The quality of frozen fish depends on how it was handled before freezing and the way it was frozen. A layer of ice glaze can protect fish from oxidation and dehydration. Buyers should check the deglazed weight of seafood because some processors attempt to sell ice glaze as a product's net weight.

Fresh or frozen, North Carolina seafood products are a good buy, says Van Housen. If it's handled properly, no one will take home a lemon.

—Sarah Friday

THE BACK PAGE

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Technically they're trawling efficiency devices. To fishermen, they're TEDs or Mr. Ts. But whatever you call them, the TED is a new piece of gear that has North Carolina shrimpers talking.

The TED was developed by the National Marine Fisheries Service for use by the commercial shrimping industry in the Southeast. It increases trawling efficiency by decreasing bycatch and improving water flow through the trawl.

The TED is a 36- by 42- by 30-inch frame built of galvanized pipe or fiberglass rod. Inside the frame are slanted deflector bars that force large objects—sea turtles, cannonball jellyfish and horseshoe crabs—out a trap door. A smaller deflector grid rids the net of finfish.

UNC Sea Grant marine advisory agent Jim Bahen is spreading the word about the devices. Using devices supplied by the NMFS, he is asking shrimpers to give the TED a try.

Norman Bellamy of Holden Beach allowed Bahen to install the devices in the nets of two of his shrimp boats. William Varnam, captain of one of the boats, has made three trips with the TEDs and likes them.

"It catches less trash fish so I can drag as long as I want," Varnum says. "Without it I could only tow about two hours before I had to empty the nets. It cuts down on culling time and hired hands. I went from four hired hands to two. I'm glad they came up

with something like this. I wish I had had it a month ago."

In a trial run, Bahen tested the TED on a double trawl shrimp boat. The TED was installed in the tailbag of one net; the other net was left as usual. The TED net eliminated 50 to 75 percent of the bycatch, while catching the same amount of shrimp.

By reducing the bycatch and subsequent culling time, Bahen says fishermen can get their catch on ice faster, making for a fresher product.

Bahen and Varnum agree that the TED eliminates another problem that has plagued the shrimp fishery this summer—dead fish on the beach. After several hours on deck, fish that are culled from the catch and pushed overboard are often dead. They wash ashore, creating an unpleasant sight and smell. But the TED virtually eliminates this problem by decreasing the finfish bycatch.

The TED also pays off in another way. It reduces the bycatch of juvenile fish. That means more fish are likely to grow to maturity—a bonus for finfish fishermen.

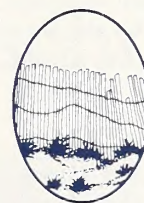
Does the TED pose any problems? Very few. Varnum says pieces of wood in the water and some "house" trash have become lodged in the TED. Otherwise, "it's working fine," he says.

Unlike earlier versions of the TED developed by the NMFS, this model is lightweight and more manageable. "It takes no longer to get the nets down or bring them aboard," Varnum says. "And I've had no problems with the TED beating against the side of the boat."

For more information about how to use or build a TED, write Bahen at the N.C. Marine Resources Center at Ft. Fisher, P.O. Box 130, Kure Beach, N.C. 28449, or call 919/458-5498.

UNC Sea Grant has received funds to promote marine-related studies from the Year of the Ocean Foundation, an organization designed to celebrate the ocean and focus on oceanic issues. The grant will be used to provide awards, publications and a

reception for high school students with prize-winning marine science projects, says Lundie Spence, Sea Grant's marine education specialist and co-chairman of the World of Water competition. As part of the World of Water events, the students and their supervising teachers will attend the National Youth Conference on Marine and Aquatic Science Nov. 12 to 15 in San Diego, Calif.



UNC Sea Grant is coordinating a research project for the U.S. Marine Corps at Camp Lejeune. The base's Onslow Beach amphibious training site is one of only two such sites for the Marines in the nation, and there is concern that the training exercises may be creating erosion problems. The Onslow Beach coastal management study will draw together a team of researchers to identify management practices that will ensure continued maintenance of the barrier island for amphibious training.

Sea Grant Director B.J. Copeland has assembled a research team to assess present shoreline processes, historical barrier island trends, and man's influence on those trends. The team includes Sea Grant researchers John Fisher and Margery Overton from NCSU and Sea Grant coastal engineering specialist Spencer Rogers. William Cleary and Paul Hosier, from the University of North Carolina at Wilmington, and Steve Benton, from the N.C. Division of Coastal Management, will also participate in the study.

The N.C. Department of Administration and the N.C. Marine Science Council are sponsoring an ocean policy conference. The N.C. Governor's Conference on Coastal State Ocean Policy will be held Oct. 30 through Nov. 1 at the Sheraton-Crabtree in Raleigh. Michael Orbach, East Carolina University anthropologist and a Sea Grant

Continued on next page

researcher, is chairman of the conference. Governor James Martin will present the opening remarks.

Orbach says the goal of the conference is to educate policymakers and the general public about important ocean policy issues facing the state and to develop a coordinated coastal state perspective on those issues.

The registration fee for the conference is \$45. For more information, call the N.C. Office of Marine Affairs at 919/733-2290 or the ECU Institute for Coastal and Marine Resources at 919/757-6779.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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COAST WATCH

Puerto Rican exchange takes teachers back to school

Photo by Sarah Friday



It didn't take much advertising for Lundie Spence, UNC Sea Grant's marine education specialist, to round up a group of qualified teachers for a special workshop in Puerto Rico July 14 to 22. Sixteen educators from North Carolina and Puerto Rico signed on the dotted line, paid their money and joined Spence and Juan Gonzalez, Puerto Rico Sea Grant's marine education specialist, for a unique cultural and scientific exchange program on the southwestern coast of the island. For the entire week, it was the teachers' turn to learn.

"This was a pilot program to see if the two education systems could work bilingually and biculturally. And it did," says Spence. "It took some translators. But on the whole, because we were using hands-on activities, language and culture were not a barrier. There was a definite exchange and a comradery."

Wanted: Teachers with a sense of adventure and a desire to explore. Must be willing to travel. Full-time one week position available. Fringe benefits to last a lifetime.

waters were located within two hours of their base in the village of Parguera.

"With a small amount of driving, these teachers were able to see a great diversity of habitats," says Spence. That's one reason she and Gonzalez chose

Eight teachers from North Carolina and eight from Puerto Rico crossed the language barrier and brought the classroom to life in the mountains, on the beaches and in the fields of Puerto Rico. The group spent part of the time in the class sharing curricula and studying the island's ecosystems, and the rest of the time probing those habitats.

For the teachers, this was a trip on the nature trail of their dreams. Coral reefs, mangrove swamps, tropical caves, experimental farms, rain forests and bioluminescent

Continued on next page

Puerto Rico for the workshop.

Like Christopher Columbus and Richard Byrd, the teachers discovered new worlds they'd never seen before. All it took was a mask and a snorkel, a microscope, a pair of sneakers and an endless supply of curiosity.

Betty Dean of McLanesville made her greatest discovery out in the swampy waters of the mangroves. A paint box of vibrant colors swam right before her eyes as she hovered over the roots of the mangrove trees. Sea anemones, featherdusters, thin-shelled clams, algae and sponges created an underwater gallery of fine art. But "the neatest thing was the fish," she says. "When you first arrived, the fish would be scared away, but if you just hung there, they'd almost come up and kiss you."

The gallery extended to the coral reefs, too. Purple fan corals, yellow butterflyfish, orange brain corals, gold starfish and the clear, blue Caribbean water invited the educators to take the plunge and see the exhibits.

The best display came on a moonless night, in a warm Puerto Rican bay when millions of dinoflagellates danced in the water. When disturbed, these microscopic marine organisms set off a glowing sparkle. Swimming in the glittering light of Phosphorescent Bay was an experience many of the teachers will never forget.

"You could never, never have anybody explain to you what you're going to see," says Lucrecia

Rousseaux of Charlotte. "There's such a big difference between seeing something in real life and looking at it in a book or at a movie. I know how enthused my kids are going to be when I tell them about it."

Sharing experiences and sights not only enriched the cultural aspect of the exchange, but also gave the teachers something more than souvenirs to take back to school.

"We wanted the teachers to learn the details of one ecosystem and, hopefully, to see similarities in ecosystems close to home," says Spence. It didn't matter whether home was on the other side of the island or 1,500 miles north. "We were looking to focus on those points which make teachers of both regions work together." By exploring Puerto Rico's environment as a group, they found out how many of the ecosystems were alike. Puerto Rico's turtle grass beds resemble North Carolina's eel grass beds, for example. And the mangroves are similar to the state's salt marshes.

"We can take back what we've learned and compare the ecosystems," says Mary Kearns, a science consultant from Greensboro. "The things we did here were so varied. . . . If a teacher looks hard, she can find not an equivalent, but a substitute for the things we saw."

Dean didn't have to look very far to find something else the two groups had in common. "We worry about our salt marshes and the conservation of our coast. The Puerto Ricans have to worry about their coast, too," she says. "The bottom line is we're all one. We all have concerns. What one of us does affects others."

Take the rain forests, for example. They're disappearing quickly. North Carolina doesn't have rain forests, but teachers should tell their classes about them and their conservation, says Kearns. "The world's concerns are our concerns. It's alive for me."

"I look at my class, my biology class, now from a different point of view," says Maritza Febo of Rio Piedras, Puerto Rico. "Why forget the sea? It surrounds Puerto Rico and constitutes two-thirds of the surface of our planet Earth."

Febo and the other teachers are taking this new perspective to class this fall, along with materials, ideas and specimens they collected from the workshop. The return on their investment for the week's activities was even more than they imagined.

"I had good attitudes," Febo says, "but now they are more firm, more concrete—about teaching, moving my fellow teachers, moving my students in marine sciences. I'm bringing material—written material, visual material. I'm bringing collections—shells, a small algae collection and a small marine invertebrates selection."

The workshop helped Eva Corchado of Isabela, Puerto Rico, too. "My attitudes towards marine education have changed, therefore I will make sure that my students develop good attitudes, too. Among

Photo by Sarah Friday



Puerto Rico's flowering hibiscus

others, I want them to respect, be interested and protect the environment, especially our marine ecosystems. I will introduce a chapter on mangroves, coral reefs, rain and dry forests when I teach my unit on environment and ecology. When I teach invertebrates, I will emphasize marine invertebrates."

"Almost everything we've done is applicable to modums in our classroom," says Frank Wheatley of Hampstead. This year, he plans to expand his biology and life science programs with information he gathered at the workshop.

Phares Sechler of China Grove also has some good ideas. She plans to transform her room into a ship or the ocean and integrate environments she saw in Puerto Rico into her chemistry, physics, earth and life science classes.

At a workshop like this one, Kearns adds, "the revitalization that the teachers experience is worth more than all the knowledge they gain, although that's important."

"This is the way you create interest," says Dean, "to get people to broaden their horizons. I think this is the kind of workshop that creates excitement."

During the week, excitement was one thing that never ran in short supply. Viewing the world's largest radar-radio telescope in Arecibo, discovering a mahogany tree, smelling fresh jasmine, seeing a barracuda eye-to-eye and meeting the people of a different culture were experiences each wanted to savor.

"We met these people on a one-to-one basis," says Spence. "Because of this, we were able to create friendships that are going to last. It's person-to-person contact that creates lasting effects. We will be sharing this for a long time."

Photo by Sarah Friday



Spence (right) and Dorothy Bjur of California explain the parts of a fish

And no doubt they will. Two North Carolina teachers started a newsletter to relay marine education ideas and news of the group. And next summer, the Puerto Rican teachers are planning to visit North Carolina.

"Because we had such a fine experience in Puerto Rico," says Spence, "we'd like to introduce the Puerto Rican teachers to a temperate environment and our educational system and involve the North Carolina teachers in looking more closely at their coastal habitats."

—Sarah Friday

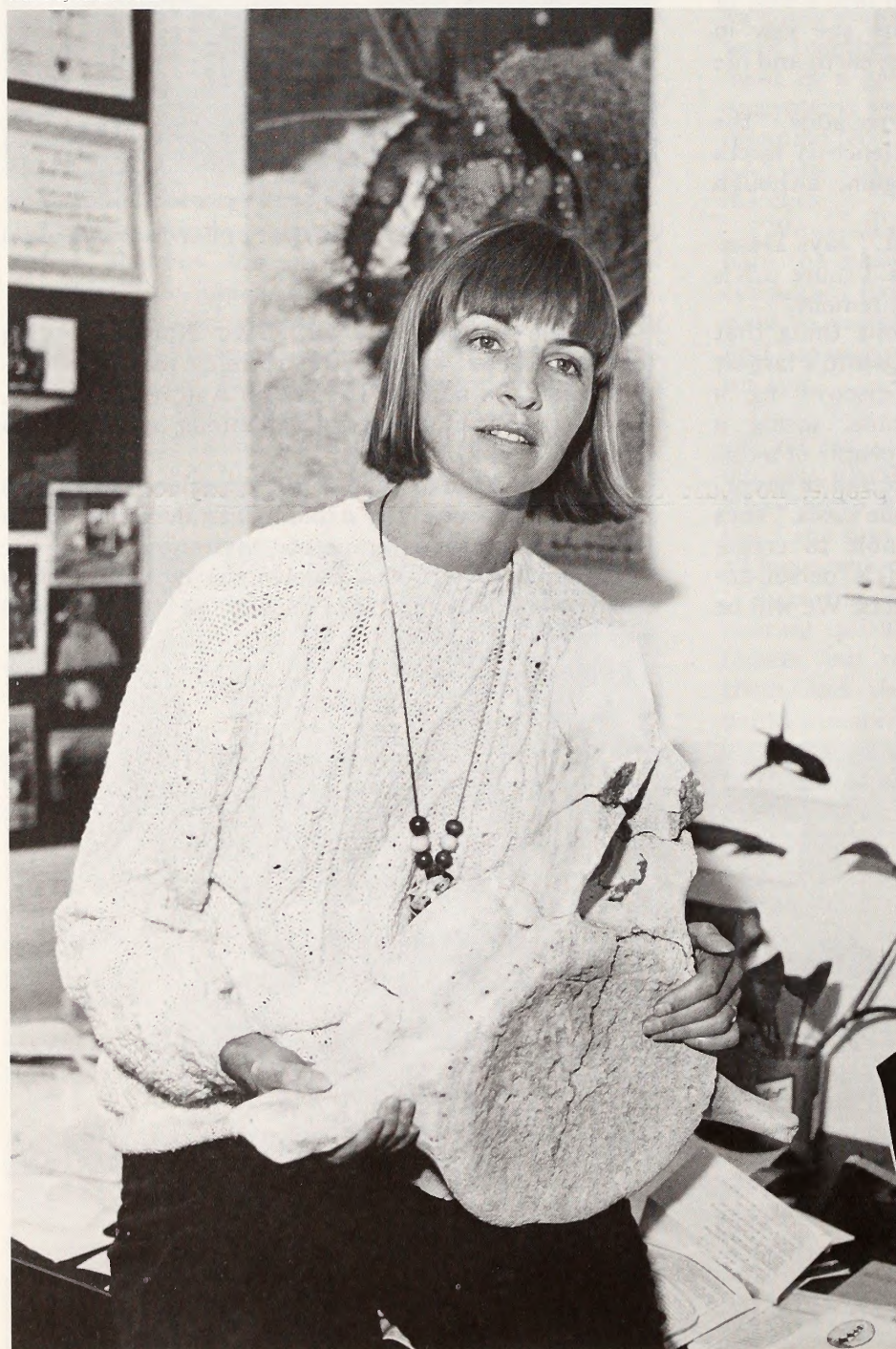
Photo by Sarah Friday



Teachers explore coastal limestone formations that were once huge sand dunes

Teachers agree Spence in a class by herself

Photo by Allen Weiss



Lundie Spence

In class or out in the field, Lundie Spence plays the Pied Piper of marine science.

SARAH FRIDAY

Lundie Spence stood at the front of the classroom giving instructions for the day's activities. The students listened intently, writing down the important points. Somebody raised a hand and asked a question. It was like any other day at school. But it wasn't.

The students were teachers, half from Puerto Rico and half from North Carolina. And the class was on the Caribbean island, getting prepped on the various corals they'd see during the afternoon's snorkeling trip.

The beauty and variety of the tropical environments lured Lundie, Juan Gonzalez and the rest of the class to take the plunge and bring the classroom to life in Puerto Rico. For a week, the teachers watched the pictures in their science books back home come alive and added a few new pages of their own.

To Lundie, learning through involvement is the key to spurring educators' interest in marine science. She, Gonzalez and Manuel Hernandez, the Puerto Rico Sea Grant director, organized the Puerto Rico workshop with this in mind.

"I wanted to design a program in which teachers become immersed in the environment," says

Lundie. Showing them around won't do the job. They need to learn investigative techniques and how to apply a new awareness and understanding in the classroom.

Without a doubt, Lundie met her goals. A few hours a day, the group met in the classroom to discuss Puerto Rico's ecosystems and to trade resource materials. The remainder of the time they set out to smell, taste, feel, hear and see the island.

Out in the field, Lundie played a Pied Piper of sorts, leading the group through mucky swamps, knee-high grasses and tangled root systems looking for specimens. She was a whiz at naming almost any plant or slinky, slimy thing that crossed her path. Together with Gonzalez, a field guide and many of the Puerto Rican teachers, she pointed out and named most every crab, coral, grass, lizard, flower, fruit or tree along the way. If she couldn't answer a question herself, she quickly asked the closest authority.

"She's something special," says Lucrecia Rousseaux of Charlotte. "She's so patient and loving . . . so good about giving the information.

She's so knowledgeable. It's an overwhelming experience. You never feel like she's being overbearing or this Spanish word "presumida"—presumptuous. She makes you feel good about what you're doing. The enthusiasm bubbles out of her."

If one of the teachers felt uncomfortable about her swimming or snorkeling skills, Lundie took her hand and guided her through the underwater world of boulder-sized corals and breath-taking beauty. When some of the class didn't understand a concept, she'd work through it with them until they did. And she was the first to make everyone feel at home, whether Puerto Rican or American.

"Lundie has a very organized sense of how to deal with people," says Phares Sechler of China Grove. "It keeps the workshop going and gets the job done.

"We could not get bored. There was more than enough for us to do. There was an allowance for us to be people, not just teachers. That's where a lot of the friendships were formed. When we shared curricula, everybody knew each other so well, it gave a beautiful depth to what

people were sharing. We were able to appreciate where they were coming from."

Five days into the workshop, the group took an afternoon to go over resource materials Lundie and Gonzalez had gathered. The books and activities selected could be adapted to science classes at almost any grade level. When the materials were not directly applicable, the texts ignited new ideas for different projects.

The story doesn't stop with these teachers in that classroom. Many of them plan to use the information from the workshop to influence others in their school or area.

"I'm going to present a mini-Sea Grant, Puerto Rico workshop to my faculty," says Rousseaux. "I want to share it with my whole school. I'm going to take the materials I have to a central place where they can be used."

"In my school," says Maritza Febo of Rio Piedras, Puerto Rico, "I plan to get my fellow teachers moving." She wants to share her specimen collections and pictures from the workshop with them.

In addition, some of the Puerto Rican teachers are planning to meet with members of AMPEN, a marine and environmental education organization, to tell them about their experiences and share the materials. Through AMPEN, they'd like to develop a network of marine educators in Puerto Rico.

Lundie was the match that lit the blaze of enthusiasm in these teachers. In one week, her ideas, encouragement and confidence established new leaders in marine science education. From here, they'll take the flames and spread them to their students and other teachers. And so long as Lundie's around, there's little chance the fire will go out.

"I don't think that anybody could have put more into this workshop," says Kearns, "or that we could have gotten any more out of it."

Photo by Sarah Friday



For Lundie, teaching marine science comes naturally

Capturing the culture

From the minute the plane touched down in San Juan, the North Carolina teachers felt welcome in Puerto Rico. Just as the wheels brushed the runway, about 300 passengers clapped fervently for the pilot.

It was a friendly and enthusiastic way to begin a week-long stay on an island posed between the Atlantic Ocean and the Caribbean Sea.

What was ahead for these teachers was a unique kind of summer school they would share with educators from a different culture. Class started when they landed, and didn't adjourn until they waved goodbye eight days later.

Immediate friendships were doubtful when the two groups first met on the back veranda of a small motel in Parguera. One group spoke mostly Spanish, and the other, mostly English. A few of the Puerto Ricans had been to America, but none of the North Carolinians had been to the island. It could have been a long week.

But a simple name game melted the ice. And soon, smiles, laughter, music, hand motions, drawings and a few translators dissolved the language barrier and helped create an atmosphere of sharing.

"I can't remember many times in my life when I have been in a place where almost every person near you was willing to give so much," said Maritza Febo. "Everywhere I looked, there was a group of English-speaking and Spanish-speaking persons struggling to communicate, to share knowledge, feelings, ideas. Language was no barrier."

"Living with the people, studying right along with them . . . that's what made this trip special," says Betty Dean. "I feel like I've been a Puerto Rican for a week."

To exchange ideas in the classroom, Spence, Gonzalez and the other speakers talked slowly and deliberately so everyone could understand. When information needed to be translated, one of four bilingual teachers would step in. However presented, the underlying message came through—that the teachers shared a common love of nature and of children.

"Their needs are the same. Their desires are the same," says Lucrecia

Photo by Sarah Friday



The workshop mixed the cultures and curricula of the two countries

Rousseaux. "They want the best for their children."

The North Carolina teachers found that their Puerto Rican counterparts want good school administrators, enthusiastic lectures, adequate texts and challenging curricula, too. But in Puerto Rico, they aren't always able to give their students what they'd like. Useful textbooks, for example, are rarely available. Latin American materials are not always suitable, they said, and those from the United States often need to be translated.

The workshop eased some of their frustrations. Spence doled out names and addresses of organizations that could provide assistance to Puerto Rican teachers. And Grace Lieberman, an education specialist with the World Wildlife Fund-U.S. in Washington, D.C., and Dorothy Bjur, a marine education consultant from Los Angeles, brought bilingual texts and activities.

Outside the classroom, the cultural exchange extended and intensified. "The Puerto Ricans are proud of their heritage and culture," says Mary Kearns, a science consultant from Greensboro. "They wanted us to see their festivals, to taste their foods, go inside their homes, meet their friends, hear their songs."

Experiences such as these gave the North Carolina teachers a better understanding of a different culture, one they could savor on their own or take

back to school.

"Riding back on the boat from the mangroves, I decided I was going to teach my children Spanish this year," says Rousseaux, who teaches the fourth grade. "There's no reason why I can't teach them Spanish, the culture. It helps them understand the world is really a small place."

The students in Pam Milvaney's biology classes in Raleigh will get a taste of Puerto Rico this year, too. Milvaney brought back slides of the different ecosystems on the island, plant specimens and something else of value—the people. "I think anytime you go any place you bring back the people you met there," she says. "So when I show those slides, I'm sure I will incorporate the lifestyles of the people who live there along with the environments they live in."

"Being there" gave Mary Sue Lane of Apex new perspective, as well. "I've become much more aware of how others live," she says. "And as a teacher, this is important because I'm much more accepting of other people's opinions." This will make an impact on her teaching, she says, because she works in the only middle school in Wake County that has English as a second language. Before the trip, she always wanted to "Americanize" her foreign students. Now she realizes they have a separate culture that is important for them to retain.

—Sarah Friday

THE BACK PAGE

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Sea Grant has awarded mini-grant funds for an interdisciplinary study on marinas and their effect on coastal water quality. Participating in the project are John Fisher and Margery Overton, of the NCSU Department of Civil Engineering; Mark Sobsey, a UNC-Chapel Hill biologist; and Rick Perdue, of the NCSU Department of Recreation Resources Administration.

One of the problems associated with the increased number of marinas along the coast is the potential for degradation of water quality. The project, which includes funds from the N.C. Division of Coastal Management, will focus on several factors which may affect water quality: the number of boats, the type of marine sanitation device onboard, the frequency of boat use, the hydrographic patterns of the currents in the area, water temperature and salinity, and levels of coliform at the site.

Previously, it has been impossible to evaluate the complex issues related to marinas and their impact on coastal water quality, says Sea Grant Director B.J. Copeland. This study will provide researchers with some basic data.

Spencer Rogers, Sea Grant's coastal engineering specialist at Ft. Fisher, is looking for someone with property on an estuarine shoreline who can help him test a design for a small estuarine breakwater.

The property must be on southern estuaries in the state (the Neuse River and south). The area should have waves less than 3 feet and a flat offshore slope; the water depth should be 1 to 2 feet for the first 100 feet offshore.

Rogers will provide the design for the breakwater, and the homeowner must provide construction costs. He estimates the cost of the breakwater will be two-thirds to one-half that of a traditional bulkhead.

If you would like to talk with Rogers about the experiment, contact him at the Marine Resources Center at Ft. Fisher, P.O. Box 130, Kure Beach, N.C. 28449, or call 919/458-5780.



In 1984, prominent scientists from across the nation gathered in Raleigh to explore the future research needs of the nation's estuaries.

This year, scientists will meet Nov. 12 to 13 in Baton Rouge, La., for the second in the series of symposia designed to examine relationships between scientific investigation and management of estuarine areas and resources.

UNC Sea Grant Director B.J. Copeland will serve as moderator for a session on mitigation measures. Joe Phillips, assistant director of the NCSU Agricultural Extension Service, will address the issue of citizen involvement.

The symposium is sponsored by the National Sea Grant College Program and the National Marine Fisheries Service. For more information, contact Jo Paula Lantier at (504) 388-6445 or Donald Ekberg at (813) 893-3720.

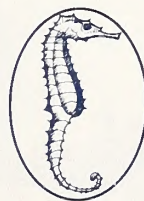
Sea Grant Director B.J. Copeland will also serve as a panelist in a regional workshop on water quality and its relation to agriculture in the Southeast. The workshop will be held in Atlanta Nov. 7 to 8 and will draw together researchers, educators and participants from agricultural

organizations and local, state and federal government.

For more information, contact the Southern Rural Development Center, Box 5406, Mississippi State, Miss. 39762, or call (601) 325-3207.

If your appetite for coastal information is just whetted by *Coastwatch*, then add another Sea Grant newsletter, *Coastal Heritage*, to your reading list. Published by the South Carolina Sea Grant Consortium, *Coastal Heritage* will feature program research, events, issues and activities. The newsletter will focus on such topics as aquaculture, advances in fisheries technology, resource management and erosion control.

For a free subscription to *Coastal Heritage*, write Communications, S.C. Sea Grant Consortium, 221 Fort Johnson Rd., Charleston, S.C. 29412-9110. To subscribe to *Coastwatch*, write Communications, UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.



Lundie Spence, UNC Sea Grant's marine education specialist, recently received an Outstanding Extension Service award from N.C. State University in Raleigh. Of over 1,000 eligible candidates, Spence was one of eight selected for the honor.

Spence was recognized for her leadership in promoting marine education at the state and national levels. Since joining Sea Grant seven years ago, she has trained numerous North Carolina educators in marine science through workshops and resource publications. In 1979, she received the Governor's Award for Outdoor Educator of the Year. In addition, Spence served as president of the National Marine Education Association from 1983 to 1984, and as chair of the National Sea Grant marine educators in 1983. She was also in-

Continued on next page

strumental in initiating the national "World of Water" science fair competition and the National Youth Conference on Marine and Aquatic Science in 1984.

In a letter to Spence, NCSU Chancellor Bruce R. Poulton congratulated her by saying, "Your efforts and devotion to the application of knowledge for individual enrichment, community development and public service exemplify the spirit and mission of our Land-Grant University."

Chris Bender of Raleigh has a prize-winning style. He's one of 16 pre-college students recently named a winner in the second annual World of Water Competition. Sponsored by the National Marine Education Association, the competition recognizes students across the nation with exceptional marine science projects. Bender was selected for his project on the reaction of schooling fish to predators.

The winners and their sponsoring teachers will participate in the National Youth Conference Nov. 12 to 14 in San Diego, Calif.



In 1984, North Carolina ranked second among trout-producing states. Rainbow trout growers produced an estimated 3 to 5 million pounds of the fish. Because the fish achieve optimal growth in waters approximately 65 degrees Fahrenheit, year-round production in this state has been limited to the mountain region.

But in the warmer Piedmont and coastal regions, water temperatures are suitable for rainbow trout from approximately late October to early May. In the winters of 1982 and 1983, Sea Grant's Associate Director Ron Hodson and marine advisory agent Randy Rouse raised rainbow trout to a marketable size in the estuarine waters of South Creek, a tributary to the Pamlico River.

Now, they've detailed the results of their research in a *Blueprint*, "Raising Rainbows." The *Blueprint* also provides advice on setting up your own rainbow trout operation. For a copy of the free publication, write UNC Sea Grant. Ask for UNC-SG-BP-85-5.

If you're a coastal resident, you probably know what salt air can do to the metal on your car. But what about other important objects on and around your house—hurricane straps, air conditioning units and door frames? Spencer Rogers, UNC Sea Grant's coastal engineering specialist, has written a new *Blueprint*, "Corrosion in Salt Air," that details the rate of corrosion along the waterfront, its effects, and the methods and materials that can be used to slow its destruction.

For a free copy of "Corrosion in Salt Air," write UNC Sea Grant. Ask for UNC-SG-BP-85-3.

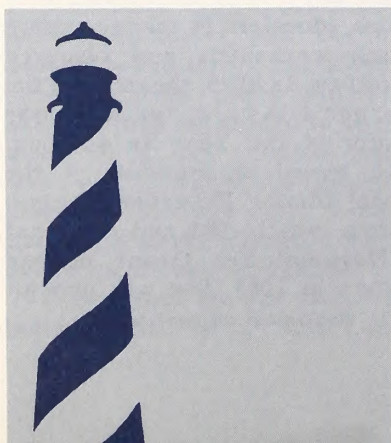
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COAST WATCH

By Steve Murray



CLAMMING

Ten years ago, hard clams were the harvest of hand clammers — those folks willing to rake or tong the bed-ridden mollusks for a few cents apiece. But things changed.

BY KATHY HART

A severe freeze during the winter of 1976-77 laid thick ice over Northern clam beds. Seafood dealers looked south to fill their orders for the bivalves, and the hard clam began living up to its

Continued on next page

Mechanical Harvesters vs. Hand Clammers

By Steve Murray



scientific name, *mercenaria mercenaria*, which means money. Mike Marshall, a shellfish biologist with the N.C. Division of Marine Fisheries, says fishermen were paid as much as 18 and 19 cents a pound then for the littlenecks (the smallest and most valuable clams used in the half-shell market).

With this financial lure before them, many fishermen turned to easier, more efficient mechanical harvest. In North Carolina, fishermen can mechanically harvest clams with a hydraulic dredge or a kicker plate.

Hydraulic dredges use a nozzle to dislodge clams from the sediment and a conveyor to bring them to the surface. To kick clams, the fisherman welds a metal plate to the rudder of the boat. The plate deflects the prop wash from the rudder to the sound bottom, where it plows an 8- to 12-inch wide path. A heavy net is pulled behind the boat to net the catch.

Mechanical harvest allowed fishermen to bag more clams and to reach deeper beds unattainable by hand harvest. The result? Landings doubled in 1977 from the previous year, and continued to climb until they reached a peak in 1982 of

more than 1.7 million pounds.

The advent of mechanical harvest stirred controversy within the fishery and headaches for resource managers. Hand rakers claimed mechanical harvesters were encroaching on their territory, wiping out their fishery. And resource managers quickly noticed the damage kicking did to grass beds. Grass beds are important refuges and growing areas for other mollusks, crustaceans and finfish.

To manage both problems, the N.C. Marine Fisheries Commission imposed restrictions. Clammers could not harvest more than 40 bags of the mollusks, which had to be at least one inch thick. Dredging was confined to waters deeper than 7 feet. And all mechanical harvest was limited to daylight hours on certain days (usually Monday, Tuesday and Wednesday) of the week from December 1 to March 31.

In 1978, the commission outlawed kicking, dredging and the use of bull rakes (large heavy rakes that also damaged grass beds) from grass beds or live oyster rock.

Today clam kicking is limited primarily to Carteret County. But last year a few areas were opened in the Intracoastal Waterway in On-

low and Pender counties.

In 1984, fishermen raked, tonged, kicked and dredged 1,388,000 pounds of the mollusks for a dockside value of \$5,506,000. DMF managers estimate that 30 to 36 percent of the harvest was mechanical; the rest, hand gathered. In 1984, Marshall says DMF handed out 300 permits for mechanical harvest; of those, 21 were for dredges.

Since 1982, landings have dropped, and many believe that the clam fishery is being overfished. Unlike scallops and shrimp, clams are a long-lived species; they can live to be over 40 years old. Their harvest represents several years of reproductive investment. Consequently their stocks are not replenished as quickly as annual fisheries.

Fentress "Red" Munden, shellfish coordinator for DMF, puts it like this: "A lot of fishermen jumped into mechanical harvest when they saw the chance and the prices were good. The result is that the fishery has grown more rapidly than the resource can respond."

Declines in clam stocks have fishermen worried. Clams represent an important source of winter income, having saved more than one fisherman from financial ruin after



Hand clammers and mechanical harvesters vie for harvest areas. Mechanical harvesters would like to drop their nets and dredges in the areas traditionally reserved for raking and tonging. But hand clammers want DMF to protect the shallow-water beds needed to sustain their fishery.

a disastrous shrimp season.

Clinton Willis, chairman of the Carteret County Watermen's Association, says the declines in recent years have been drastic. He predicts that fishermen have one more year of profitable kicking harvest. His group is asking for new management schemes and more harvestable area.

Although DMF would like to open more area for mechanical harvest, "we've given them everything we can without getting into the rake and tong areas," Munden says. "We're caught in the middle. The hand rakers are not going to agree to give up any of their area for mechanical harvest, and the mechanical harvesters aren't going to be happy until we open these areas."

This year to lengthen the availability of mechanically harvested clams throughout the season, the fisheries commission gave DMF Director Robert Mahood the authority to set bag limits by proclamation. Using his authority, he can raise and lower bag limits as the need arises.

Willis says his group would like for DMF to begin a rotation system where areas periodically would be

opened and closed to kicking. This would allow stocks in closed areas to replenish themselves.

Munden says the division has talked to fishermen about a rotation system, but until now the fishermen have not been in favor of the idea. DMF also presented the rotation system to the marine fisheries commissioners.

The rotation system proposed by DMF would subdivide the area already opened to mechanical harvest. Munden says the commission wants more information on such a system, and Sea Grant researcher Charles "Pete" Peterson is conducting studies now that may help base the rotation system on scientific facts—recruitment, growth and mortality rates for various habitats.

Willis also would like DMF to move, or pay fishermen to move, clams from closed polluted areas to clean public estuarine bottom. There, they could be held "in trust" until they cleansed themselves of their pollutants and spawned. Then they could be harvested.

Munden says DMF has done a limited amount of relay in the past, but funds are generally not available for such a program. DMF has worked closely with the N.C. Divi-

sion of Shellfish Sanitation to establish criteria for temporary openings in polluted areas. When water quality standards in these areas rise to "safe" levels, the waters are open to harvest whether it's during the normal mechanical harvest season or not. And since the opening is temporary, no bag limits are set.

"With a few exceptions, there are not that many clams left even in polluted areas," Munden says.

Last summer in a legal effort to force open more harvestable area for hydraulic dredges, 18 fishermen filed a lawsuit in U.S. District Court in New Bern challenging the constitutionality of DMF regulations that limited their harvest.

The attorney general's office denied that the regulations were discriminatory and requested that the lawsuit be dismissed. No action has been taken in the case.

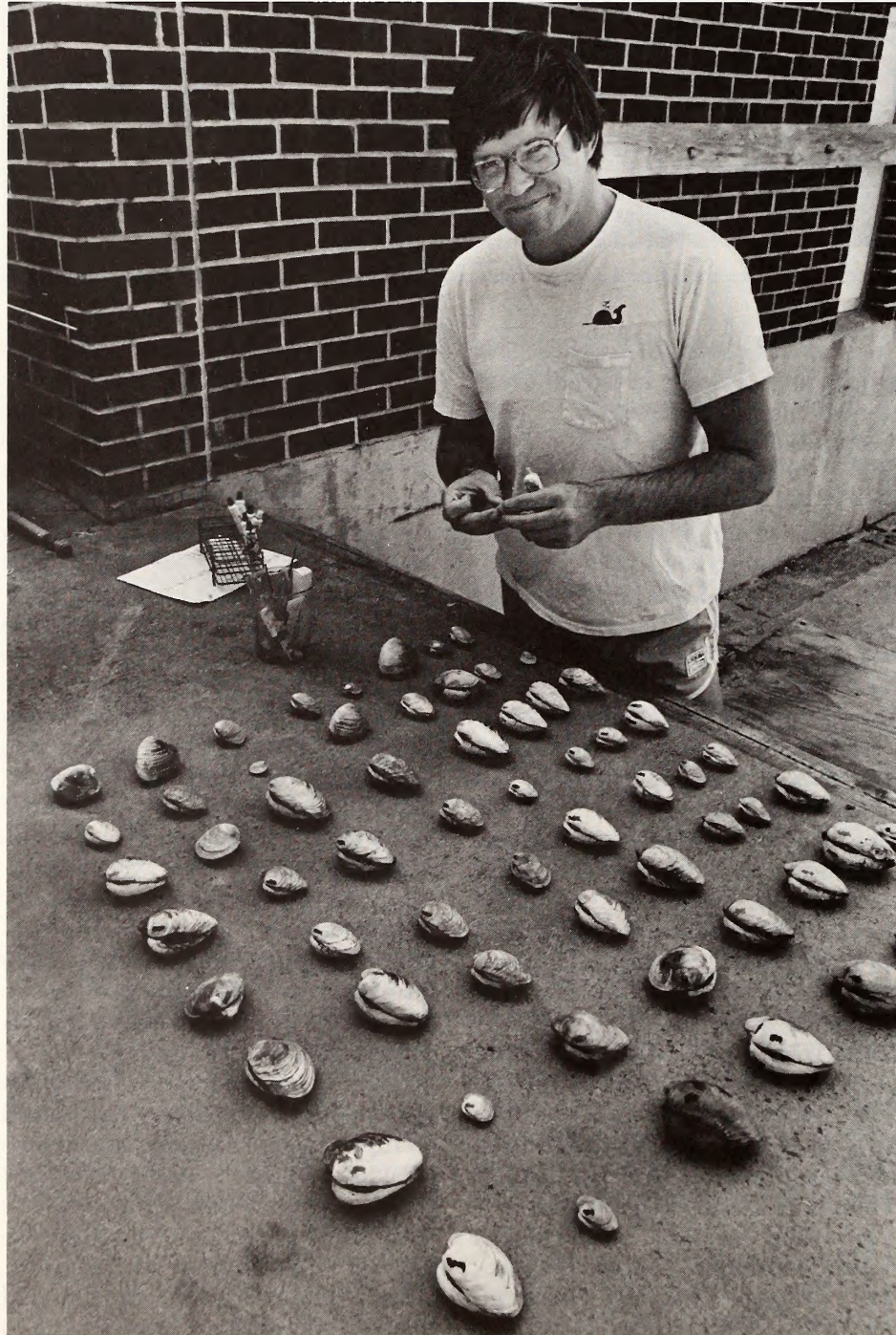
But Munden says the restrictions are needed to ensure that hand clammers, kickers and dredgers—have fair access to clam resources.

As clams become limited, the scramble for these valuable bivalves becomes more frantic. Hand clammers and mechanical harvesters want a chance to dig up this mollusk that means money.

Kicking Up More Than Clams

Studying the effects of clam kicking on seagrass

By Allen Weiss



Peterson paints clams for later identification in the laboratory

BY KATHY HART

The results can be deciphered from graphs in a scientific paper. But the real proof is a grass bed in Back Sound. Either way, the conclusion is the same: clam kicking is harmful to seagrass beds. And anything that adversely affects seagrass spells trouble, unproductive trouble.

As part of a large Sea Grant project to study the biology of the hard clam and the effects of its harvesting methods, researcher Charles "Pete" Peterson sectioned off plots of seagrass in Back Sound to test the effects of clam kicking. Some of the plots were left untouched and used as controls to measure against the effects of raking, light kicking and intense kicking in other plots.

In the raking and light kicking plots, seagrass biomass dropped approximately 25 percent immediately after harvest. But within a year's time, these beds completely recovered.

In the intensely kicked plots, seagrass biomass fell by about 65 percent immediately after harvest. The beds did not begin to recover for two years. And four years later, the intensely kicked plots still had 35 percent less seagrass than the control plots.

Why the concern for a bed of submerged grass? Peterson explains: "Seagrass stimulates productivity. It's part of the detrital food chain. The grasses also function as habitat for small invertebrates and other creatures. It provides a surface for the attachment of young scallops, and juvenile clam settlement is higher in grass beds. It also affects shrimp production."

The bottom line? Seagrass is an important part of the estuarine ecosystem. It provides food, directly or indirectly, refuge and habitat for the small-

est marine microorganism to the largest fish. More directly stated: Seagrass abundance can affect how many shrimp, scallops and clams the consumer can heap on his plate. Even for the clam that is being harvested, seagrass is important to the productivity of the population.

When it comes to refuge, grass beds offer added protection. Peterson learned that the whelk, one of the clam's life-long predators, can decimate a clam population within five warm-water months along sandy estuarine bottoms. But among blades of seagrass, the hard clam can more easily hide from its footed foe.

In some cases, seagrass also may help the clam in its procurement of meals. Many biologists have long believed that growth rates were higher in areas where strong currents delivered more food. But Peterson found that the reduced current flow caused by the the presence of grass beds can deliver more food, in some cases, to the clam's sediment level and increase the bivalve's growth.

To test the theory that seagrass cover affected the abundance of other species, Peterson examined populations of bay scallops. He found that bay scallop density dropped as seagrass de-

clined as a result of clam kicking. But the intensely kicked plots contained even fewer scallops than expected. Peterson suspects the greater decline is caused by the patchy grass cover left after kicking. If the remaining cover were evenly distributed, scallop densities would be higher, he speculates.

At N.C. State University, Sea Grant researcher Jim Easley took an economic approach to the question of clam kicking's effects on bay scallops in grass beds. Using a computer model, Easley fed in a variety of economic, biological and fishery information. When the results were computed, Easley found that clam kicking and raking had significant negative effects on the number of scallops available for harvest in grass beds.

Does clam kicking, in a seagrass bed or out, increase next year's crop of baby clams? This was a commonly held belief among Carteret County clam kickers. They thought that clearing the estuarine bottom of larger clams made more room for baby clams. Peterson tested the notion.

He learned that the removal of adult hard clams by kicking did not enhance the recruitment of baby clams. In fact, in intensely kicked sand plots recruitment was 50 percent lower than in the

control plots. In intensely kicked seagrass beds, recruitment fell by 15 percent. Peterson attributes the decline to the disturbance of sediment caused by the kicking. "Environmental damage caused to seagrass beds and to dependent fisheries production is not balanced, even in part, by any increase in local hard clam recruitment or by any other obvious benefit," he says.

The N.C. Division of Marine Fisheries had suspected the beds' importance and the adverse effects of kicking; consequently they closed the beds to mechanical harvest in 1978. "My results added biological teeth to a policy that DMF had already been following," Peterson says. "Now they can say to the fisherman who wants a grass bed open to harvest, we have scientific proof that kicking harms the beds and beds have advantageous impacts on clams and other fisheries, especially shrimp and bay scallops."

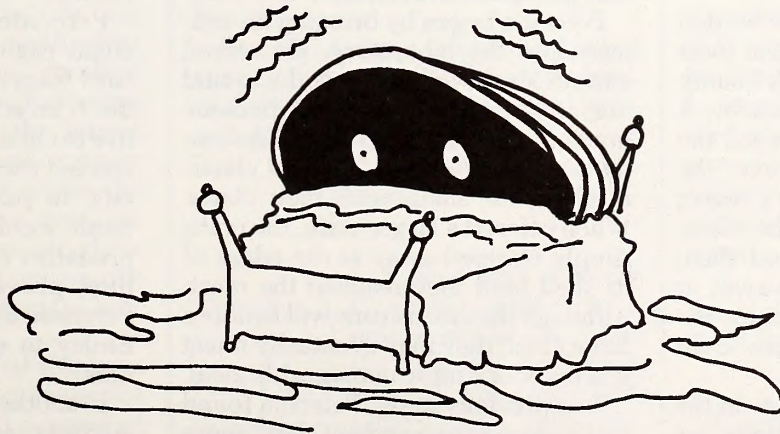
But what of the clams nestled in these grassy beds? Are they a resource lost to the fisherman? No. Many of these clams can still be harvested by use of rakes. But more importantly, Peterson believes these protected mollusks, if left unharvested, can parent the thousands of clams needed to repopulate harvestable area tomorrow.

Aging clams still active in bed

A rumor circulating among coastal fishermen had hard clams hiding shamefully in their beds. According to the rumor, hard clams became, how should we say, sexually inactive, or more delicately stated, reproductively senile, as they became older and bigger. No wonder these soft-bodied mollusks had withdrawn into their shells.

Already large clams had been labeled as tough, fit only for a pot of clam chowder. But as the rumor of their inabilities spread, fishermen lost even more respect for the larger mollusks. Clammers complained that the chowders occupied valuable bed space that would be better used by a younger, more productive set.

But Sea Grant researcher Charles "Pete" Peterson made a discovery that will gain the chowder clam new respect. He



learned that older, larger hard clams aren't reproductively senile at all. In fact, the number of gametes, or reproductive cells, a clam produces is directly proportional to its size.

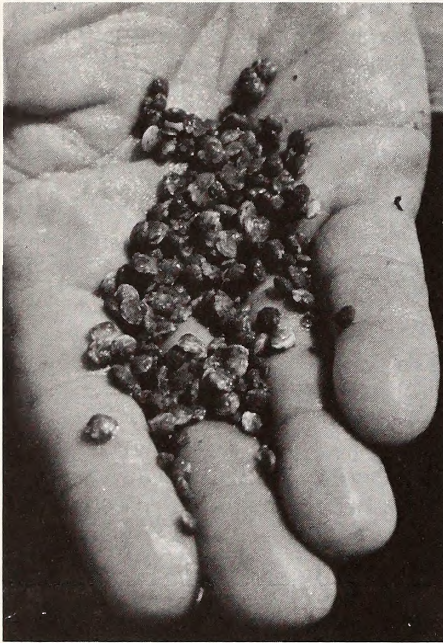
In Johnson Creek in Core Sound, Peterson dug out one large clam that turned out to be 46 years old. "It was the oldest *mercenaria* ever recorded, and it had gam-

etes to beat the band," Peterson says.

"This is important information because if we argue that undamaged seagrass beds play a significant role as natural predation refuges for a breeding stock of older adult clams, it is critical to show that they do continue to reproduce with age," he says. "Not only does the hard clam continue to produce gametes as it ages, but also the number of gametes produced increases dramatically with size and age."

PLANTING CLAMS

By Gef Flumlin



Baby clams

BY NANCY DAVIS

A juvenile clam lays nestled in its bed among the roots of seagrass in Back Sound. But danger lurks nearby. A blue crab makes its way toward the young clam. Helpless to move, the clam finds itself in the crab's strong claws. The crab picks up the clam, handles it for a moment, and then, using its claws, begins to chip away at the clam's shell. Within minutes, the crab pops the meat of the baby clam into its mouth.

The crab continues to forage in the clam bed, attempting to satiate his appetite. Just one clam won't be enough. In a short while, the crab leaves a path of destruction.

Nature is not kind to young clams. The mortality rate among three-millimeter seed clams is about 95 percent, says Sea Grant researcher Charles "Pete" Peterson. Although the blue

crab is a major predator, it is not alone in its appetite for clams; mud crabs, stone crabs, shrimp and snapping shrimp, bottom-feeding fish, moon snails and whelks also take their toll. Such high mortality rates are common among species in the natural environment, but they pose problems for clam culturists.

Clam gardening is a form of aquaculture in which seed clams are purchased from a hatchery, then placed on estuarine bottom leased from the state. The clams are protected until they reach a marketable size.

Peterson says, "The only remaining unsolved problem in the technology of 'clam gardening' . . . is predator prevention."

In 1983 and 1984, Peterson approached the clam mortality problem from several angles. He wanted to know at what size a clam becomes invulnerable to predators, and if clam gardening could be made economically viable through manipulation of seed clam size, season of planting and the use of anti-predation structures.

Peterson began by bringing his subjects into the laboratory. He served various sizes of clams to crabs to find out at what size the clams become invulnerable. He found that crabs easily make a light meal of small clams, crushing the shells with their claws. When offered a larger clam, the crabs simply chipped away at the edges of its shell until they reached the meat. Although the crustaceans will handle a large clam, they may eventually reject it in favor of a more manageable meal.

In a previous study, Peterson found that a clam's environment determines its rate of growth; the mollusks grow faster in some areas than in others. For example, growth rates for clams at sites in the North River and Newport River were three times higher than at sites in Bogue Sound.

In turn, growth rates affect the rate of predation. In areas with slow

growth rates, it takes longer for clams to become less susceptible to their natural enemies.

Peterson measured growth rates for clams in 10 sites. Then he gathered data on clam mortality in those locations, and tested some theories.

Peterson knew that for a period during the winter, hard crabs remained relatively inactive. At the same time, unlike clams growing in northern waters, the mollusks continue to grow here during colder months. Peterson hypothesized that seed clams planted in the winter would grow large enough by spring to be relatively invulnerable to crab predation.

At his test sites, Peterson planted three sizes of seed clams and grew them through the winter, with little loss to predation. The next step will be a cost analysis. Since price varies for the different sizes, Sea Grant economist Jim Easley will weigh those costs against the rate of survivorship. Culturists need to know which size seed clam will give them the best return for their money.

Peterson tested another theory: could caging out predators improve hard clam recruitment enough to render it an economically viable alternative to clam hatcheries? To find out, he erected exclosures in a variety of habitats. In particular, he tested a light mesh webbing designed to exclude predators from clam beds. The webbing proved effective, but before Peterson recommends its use, he wants Easley to evaluate its cost effectiveness.

In another Sea Grant project, marine advisory agents Gary Van Housen, Bob Hines and Randy Rouse and fishermen Gary Culpepper and Mark Hooper are testing the possibility of using crab shedding tanks during the off-season for holding seed clams. Fishermen could buy the smaller, less expensive clams and hold them until they reach a sufficient size for planting.

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In early April, uncontrollable blazes roared through eastern North Carolina destroying thousands of acres of forestland. High winds, warm temperatures, low humidity and dry soils combined to create one of the worst fire seasons in 50 years. The Pungo fire, which was the largest, burned more than 96,000 acres in Hyde, Tyrrell and Washington counties. Its flames devastated the forest's flora and destroyed much of the fauna.

"Generally speaking, fires are beneficial to a lot of species of animals and plant growth, but this fire covered such a large area that the majority of game in the center of the fire was killed," says Carl Betsill, small game and migratory bird program coordinator for the N.C. Wildlife Resources Commission. Betsill saw the largest impact on animals the size of raccoons and smaller that could not escape the flames. Unless they were near the fringe of the forest, most of these animals were killed. Heat and smoke from burning peat killed even the burrowing animals.

Deer populations suffered also, says Scott Osborne, deer project leader for the commission. About 20 percent of the deer in that area died, with another 20 percent injured by the fire.

The loss of animals is very brief, however, says Osborne. Since the fires, habitats have recovered quickly. One of the first things to come back, he says, is bracket fern, followed by shrubs and aquatic vegetation. "This is

better for the animals," says Osborne. Nutrients from the fire enrich the soil and create fertile feeding grounds and good cover.



During the winter, North Carolina's coastal marshes and sounds provide an ample supply of food for migrating birds such as ducks, geese, gulls and willets. But other birds call the Carolina coast home, too. Many of the same birds that inhabit other areas of the state, also frequent coastal backyards. For those birds, finding food is not always as easy as a stop at the nearest marsh.

Should you help these feathered friends in their search for food? James Parnell, an ornithologist at the University of North Carolina at Wilmington, says bird food can provide a helpful supplement when other food is hard to find. Parnell cautions that consistency is important. "Don't begin feeding them in the fall and then halfway through the winter quit, because those birds will have become dependent on you. But as long as you maintain the feeding program through the winter, then it probably is very helpful," says Parnell.

Parnell advises feeding the birds a commercial mix, usually a combination of sunflower seeds, cracked corn and millet. You can alter the mix as you learn more about the birds' preferences, says Parnell.



Take a look at North Carolina's coast from a new perspective—from the legal side. Beginning this fall, Sea Grant will offer a free, quarterly newsletter addressing coastal legal issues such as water use rights, development and offshore oil leasing. Edited by Walter Clark, Sea Grant's coastal law specialist, *Legal Tides* will tackle pertinent coastal legal questions as they arise.

It will emphasize a whole spectrum

of jurisdictions, says Clark, from the oceans to the coast to the rivers and sounds. "Within each of those is a multitude of problems that can affect North Carolina," says Clark. International, national, state and local issues can have an impact on our resources. "For example," he says, "an issue that falls under state jurisdiction right now is settling ownership claims regarding submerged lands under state waters."

Clark, attorneys and others involved in the questions concerning North Carolina's coast will write the articles for the newsletter. To receive *Legal Tides*, send your name and address to Walter Clark, UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605.

UNC Sea Grant has recently published the preliminary results of a three-pronged multidisciplinary research effort aimed at studying the effects of freshwater drainage on estuaries. Much of eastern North Carolina's fertile lowland must be drained to be farmed. The freshwater drainage from these fields often is funneled into the estuary, sometimes into primary nursery areas.

The report, *Water Management and Estuarine Nurseries*, details the work of Wayne Skaggs and Wendell Gilliam on land use alterations and runoff, Leonard Pietrafesa's research on the response of estuarine circulation patterns to freshwater runoff, and John Miller's findings on the response of juvenile fish and shellfish to freshwater input.

For a copy of this free report, write Sea Grant. Ask for publication UNC-SG-WP-85-2.

In a recent study of North Carolina schools, it was found that a low proportion of high school blacks and women were enrolled in college preparatory mathematics and science courses. Consequently, fewer blacks and women enter these fields of study in college.

Continued on next page

The Consortium for Minorities and Women in Mathematics and Science recommended that funds be provided to the University of North Carolina Mathematics and Science Education Network for a pilot program designed to increase the participation of blacks and women in these classrooms.

UNC Sea Grant will provide \$5,000 toward the pilot program, which will initially involve a coordinator who will work to obtain government, corporate and foundation funds to further the program. Once support for the project is obtained, the program will begin its work with minorities and women in grades 6 to 9 to increase their interest and skills in science and mathematics.

UNC Sea Grant Director B.J. Copeland has been selected to serve on the advisory council of the National Coastal Resources Research and Development Institute in Oregon. The mission of the institute is to "initiate, develop and support research, education and demonstration projects that promote economic development and diversified use of the nation's marine and

coastal resources, consistent with maintenance of environmental integrity and with due regard for social responsibility and consequences."

Copeland was one of 12 candidates chosen for the council because of his expertise in the field of coastal and marine resources.



The face of the coast is changing. Increased development has spurred the need for better planning and controlled growth in the coastal areas of North Carolina.

To help address this issue, Simon Baker, a professor in the Department of Geography and Planning at East Carolina University in Greenville, has written *A Land Use and Land Cover Classification of the North Carolina Barrier Islands: Level III*.

This new publication offers a detailed classification system for mapping land use and land cover on the barrier islands, expanding the two-level system previously adopted by the U.S. Geological Survey. Seven

additional categories of land use and land cover are described in the text and illustrated with more than 100 aerial and ground photographs. Coastal managers, planners, business owners and government officials can use this information to make quick and positive classification decisions and as benchmark data against which future changes can be measured. It is compatible with the national classification and mapping system of land use and land cover.

For a copy of Baker's book, write Sea Grant. Ask for UNC-SG-85-03. Cost is \$3.50.

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COASTWATCH

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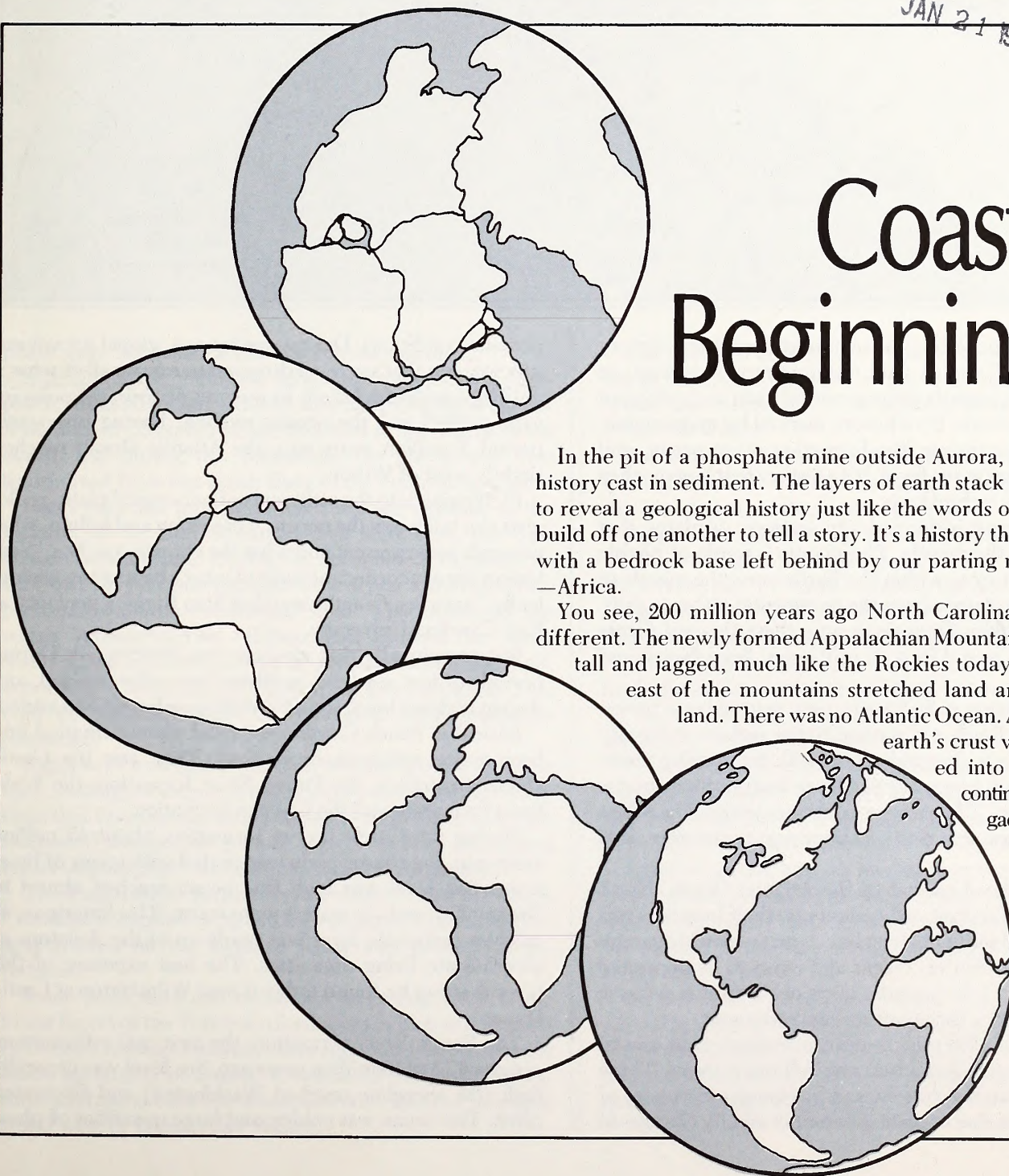
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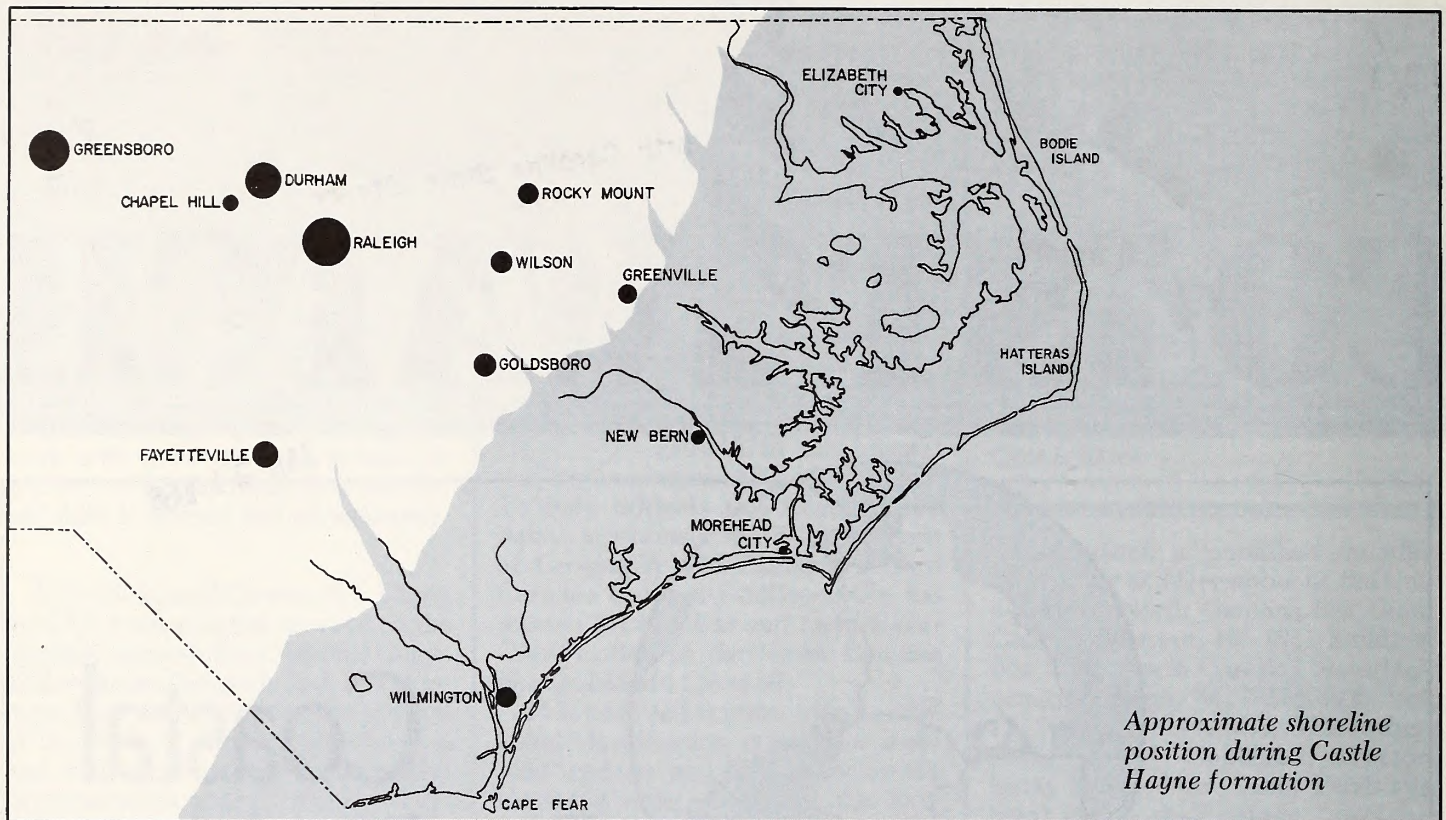
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Coastal Beginnings

In the pit of a phosphate mine outside Aurora, there's a history cast in sediment. The layers of earth stack together to reveal a geological history just like the words of a book build off one another to tell a story. It's a history that began with a bedrock base left behind by our parting neighbor — Africa.

You see, 200 million years ago North Carolina looked different. The newly formed Appalachian Mountains stood tall and jagged, much like the Rockies today. To the east of the mountains stretched land and more land. There was no Atlantic Ocean. All of the earth's crust was locked into a single continent, Pangaea, meaning all lands.





Approximate shoreline position during Castle Hayne formation

A lot of geologic history has occurred since then—history that left North Carolina with rounded mountain tops, an ocean to its east, a gentle sloping coastal plain and a string of sandy barrier islands. It's a history marked by major movements in the continents, the formation of an ocean, and large fluctuations in sea level. It's a history that began when Pangaea started to break up.

The earth's crust is divided into sections, or plates, that float on top of the mantle. The mantle is made of pliable rock. Thermal forces within the Earth cause the mantle to move, which, in turn, causes the continental plates to shift. About 160 to 180 million years ago, these thermal forces caused Eurasia and Africa to pull away from North and South America.

As the continents pulled apart, new material was generated inside the Earth and pushed to the surface at the rift. This material was dragged along with the parting continents, creating an ever widening basin that gradually began to fill with water. (This process continues today. The Atlantic Ocean grows at a rate of about one centimeter each year.)

During the development of the Atlantic Ocean, North Carolina's coastal plain and continental shelf began its formation. Eroded sediment from the Appalachian Mountains washed downstream via creeks and rivers to be deposited in coastal areas. And periodic invasions from the Atlantic Ocean deposited a variety of marine sediments.

Throughout the 160 million-year formation of our coastal plain, the Atlantic Ocean rose and fell many times. These sea level fluctuations were caused by changes in the size of the ocean basins due to plate movement and by changes in

climatic conditions. During one ice age, global ice volume was so great that sea level dropped to expose all of what is now the continental shelf. In warmer periods, the polar ice caps melted and the oceans swelled. During one warm period 5 million years ago, the Atlantic Ocean reached slightly west of Wilson.

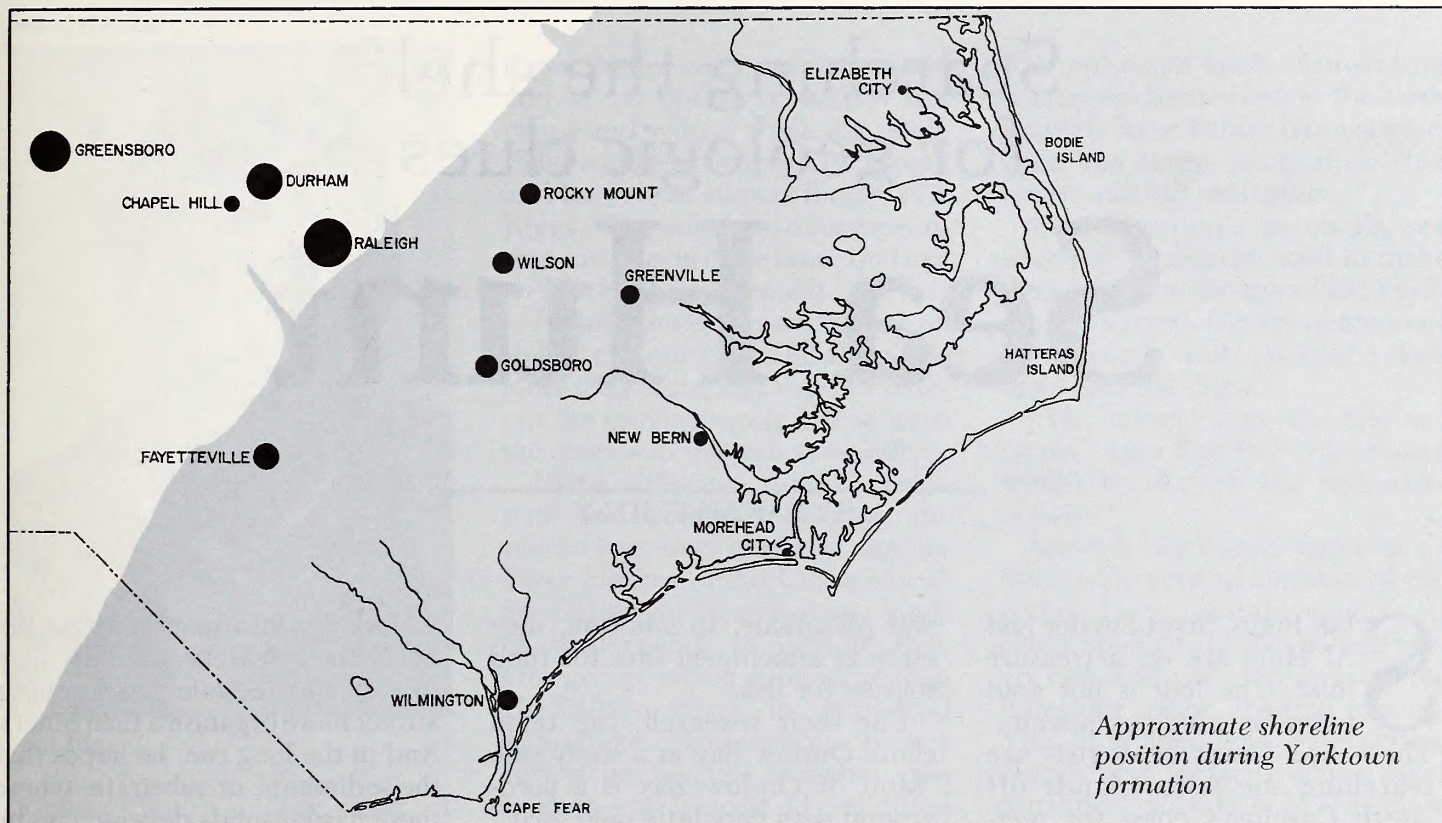
By digging into the sediments of our coastal plain, geologists can tell when the oceans were rising and falling, what minerals were present and what the climate was like. "Sediments are a recorded message of what's happening geologically," says Sea Grant researcher Stan Riggs, a geologist at East Carolina University.

But occasionally that message was interrupted. During periods of low sea level, sediment was often eroded, and during high sea level, sometimes little sediment was added.

Basically, North Carolina's coastal plain is divided into four major sediment formations. They are: the Castle Hayne formation, the Pungo River formation, the Yorktown formation and the Croatan formation.

During the Castle Hayne formation, about 45 million years ago, the coastal plain was coated with layers of limestone. Sea level was high (the ocean reached almost to Greenville), and the waters were warm. This limestone, or calcium carbonate layer was made up of the skeletons of invertebrate living organisms. The best exposure of this layer that can be found today is near Wilmington at Castle Hayne.

The Pungo River formation, the next major formation, occurred 13 to 19 million years ago. Sea level was generally high (the shoreline reached Washington) and fluctuated often. The ocean was colder, and large quantities of phos-



phate were deposited across the continental shelf.

Although some geologists debate the source of the phosphate, Riggs advocates a theory based on ocean upwellings. A buildup of phosphorus had occurred in the depths of the ocean. But during this formation, the phosphorus was transported from the ocean floor to the continental shelf.

Riggs says this transportation occurred because of the location of the Gulf Stream. If sea level rises, the Gulf Stream moves inland. During the phosphate formation, the Gulf Stream was moving landward when it bumped into protrusions of the continental shelf. This deflected the warm surface current offshore and allowed the ocean water beneath to rise and spread over the continental shelf, according to Sea Grant oceanographer Len Pietrafesa. This cold nutrient-rich ocean is associated with phosphate formation.

Riggs says eventually the Gulf Stream moved onto the shelf, cutting off the phosphorus supply and creating conditions that favored carbonate deposition. Because sea level fluctuated during this period, geologists find alternating layers of phosphate and carbonate in this formation.

The Pungo River formation is a valuable one for North Carolina. Phosphate is mined by Texasgulf Chemicals Co. near Aurora on the Pamlico River and processed into fertilizer.

Some phosphate and carbonate were deposited in the lower layers of the Yorktown formation, which was formed between 3 1/2 and 5 million years ago. But this formation is made up largely of quartz. Continental margin temperatures alternated between warm and cold, and the shoreline stood west of present-day Wilson.

The youngest geological formation, the Croatan, flooded less of the coastal plain (shoreline in the vicinity of Aurora). Warm seas during this era left behind dense layers of carbonate shell hash.

But sediment formation isn't the only North Carolina geologic feature to interest scientists. The ever mobile barrier islands are another feature of study.

Riggs says the present barrier islands formed about 18,000 years ago after a glacial era. Global warming caused sea level to rise. In North Carolina, the ocean flooded low-lying areas, but left behind strips of high-standing beach that had formed from ocean and river deposits.

North Carolina may have seen many such sets of barrier lands during its formation. Multiple barrier formations can be traced across the coastal plain. Greenville lies on one such ridge, Tarboro on another.

Today's barrier islands are a geologic feature in motion. They are a product of the wave energy that builds, molds and maintains them, Riggs says. In response to the continued rise in sea level (the world is still recovering from its last glacier period, and sea level rises in North Carolina at a rate of about one-half foot per century), the barrier islands are moving inland via washover and inlet migration. And as the islands move, the estuaries behind them also push westward.

Barrier island movement, rising sea level, the ever-widening Atlantic basin and the continued deposit of sediments add up to a coastal plain still in creation. As geologists delve in its sediments to reveal its past, they also use their findings to predict its future.

—Kathy Hart

Searching the shelf for geologic clues Sea Hunt

BY SARAH FRIDAY

Stan Riggs, Scott Snyder and Al Hine are on a treasure hunt. The loot is not gold coins or precious jewelry. These Sea Grant geologists are searching the bottomlands off North Carolina's coast for reef-type structures that hold a wealth of natural resources.

The structures, called "hardgrounds," lie anywhere from just beyond the shoreline to the edge of the continental shelf throughout the East Coast. These underwater mesas occur in association with sediments rich in heavy minerals

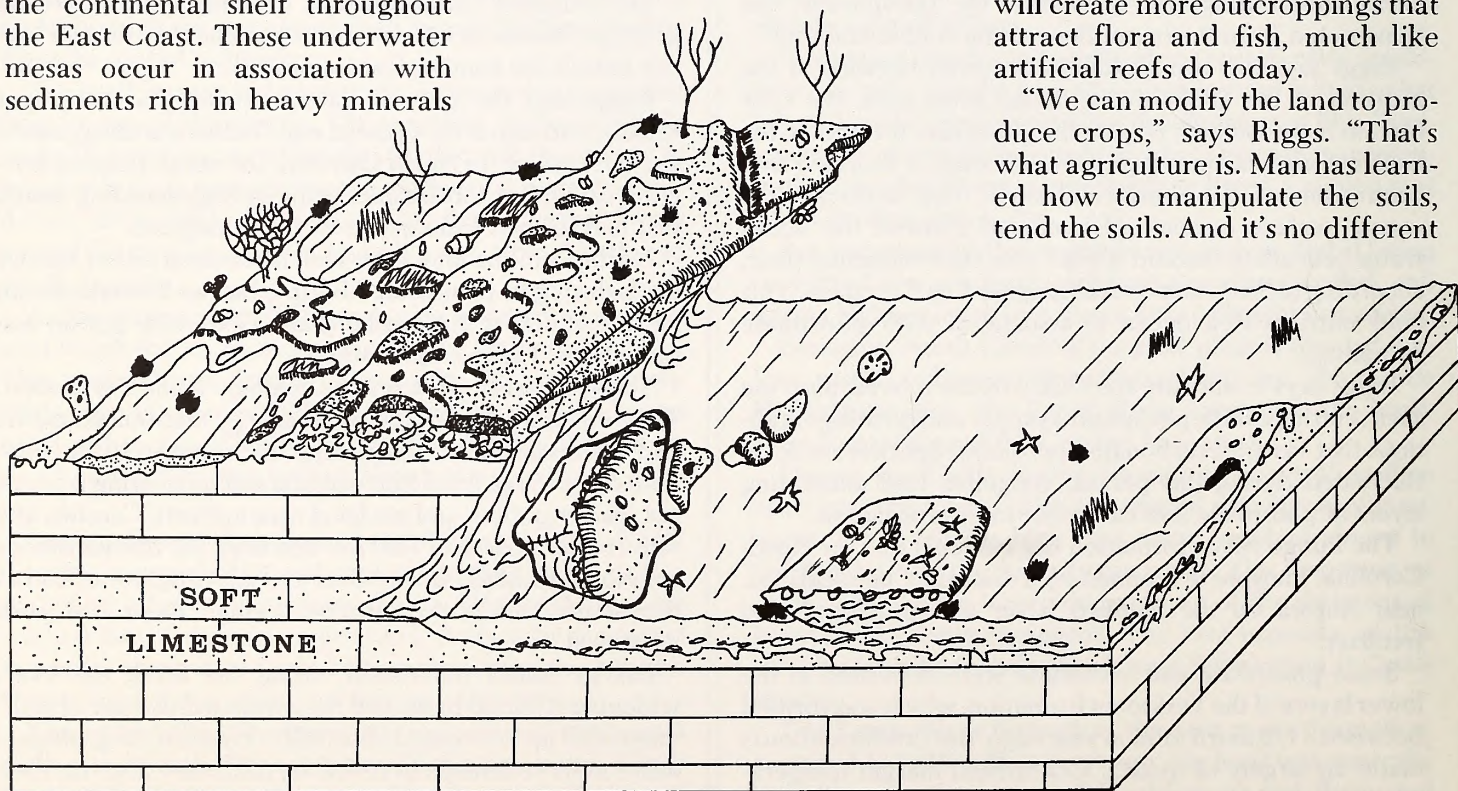
and phosphate. In addition, they serve as attachment sites for food sources for fish.

For their research, the team chose Onslow Bay as a study site. "Most of Onslow Bay is a hardground with very little sand on it," says Riggs. "What we're trying to do is understand what are the different kinds of hardgrounds? Where do they occur? What is their geologic nature?"

With this information, Riggs believes the researchers will be able to tell why certain hardgrounds attract more organisms than others. And in the long run, he hopes that the sediments, or substrate, where these hardgrounds develop can be made more productive.

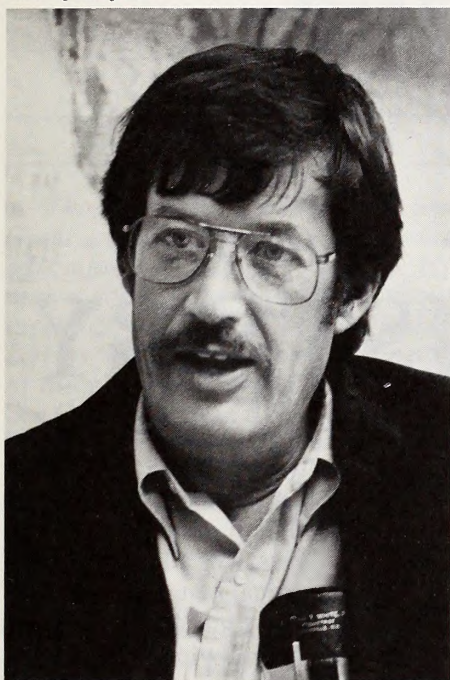
Riggs believes that someday it may be possible to "plow" the shelf floor to build ridges of rock above the abrasive flat sands. These ridges will create more outcroppings that attract flora and fish, much like artificial reefs do today.

"We can modify the land to produce crops," says Riggs. "That's what agriculture is. Man has learned how to manipulate the soils, tend the soils. And it's no different



Scarp like this on the underwater mesas of Onslow Bay collect a variety of corals, other organisms and, eventually, fish

Photo by Kathy Hart



Stan Riggs

because there's a little layer of water on top of this. It's just like a soil there. And if we understand the physical, biological and chemical processes of that system, then we ought to be able to manage that system in the same way we manage an agricultural field. And we ought to be able to increase the productivity out there.

"There's a lot that has to be done before that resource is potentially developed," says Riggs. "We must first understand it."

So far, what the researchers have learned is that hardgrounds differ greatly. Variables in their composition and shape affect the types of communities of organisms they attract.

The first question Riggs asks is what kind of substrate lies in certain areas of the shelf floor. The type of rock will determine the amount of organisms that will grow there. The floor can be barren or can have whole reef developments on it with corals, algae, fish and other marine life.

Some sections of Onslow Bay are made up of a fine mud or coarse, mobile sand, says Snyder, a geologist at East Carolina University. In

these areas, sand moves around and keeps boring organisms like clams and worms from attaching. "The sediment waves come over and bury them and kill them," says Riggs. "The only kind of organisms that can live on it are those that can withstand the movement."

Prolific development occurs on the outcroppings that jut above the loose sediments, says Snyder. Without the moving sands, larvae have the chance to become established.

Using side-scan sonar, seismic data and bottom television, the researchers and graduate student Dave Mearns of the University of South Florida located many kinds of hardgrounds in Onslow Bay. One group, which dates more than 10 million years, is small and moundlike. They measure from a few inches to a few feet above the bottom and consist of solidified muds cemented together with calcium carbonate, or limestone. These hardgrounds attract only a few types of organisms.

Younger hardgrounds—1 or 2 million years old—offer the richest substrate. Composed mostly of limestone, these outcroppings rise up to 10 meters above the shelf floor and dot the bay. Many of these mesas formed when rivers cut across an exposed continental shelf and created huge valleys. The ledges, or scarps, produce big, nice reefs, says Riggs. "These are the ones fishermen are interested in; the ones divers want to dive on." And they're the main type he, Snyder and Hine, a geologist at the University of South Florida, want to locate, study and map.

One reason is that these hardgrounds occur near sediments that contain potential mineral resources such as shell and quartz gravels, gold and uranium. They also serve as future sources of phosphate and of sands for beach replenishment.

These younger outcroppings win their all-around popularity, however, for serving as attachment sites for organisms that attract fish.

The two major kinds of organisms that secure themselves to the hardgrounds have names like warriors from the latest sci-fi flick—the borers and the encrusters.

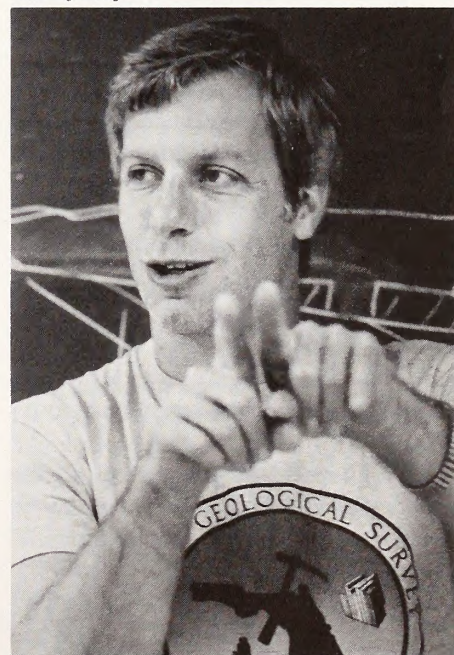
Encrusters such as corals, sea whips and barnacles tend to make their home on the top of the hardground's scarp. Generous amounts of nutrients and sunlight invite them to settle there.

"The encrusters get the best real estate," says Snyder. "The borers would be there if the encrusters weren't."

Instead, the borers move in on the lower, vertical surfaces of the scarp. Here, certain species of clams, sponges and mechanical borers continuously chip away at the limestone ledge, creating erosion. This, combined with wave action, shapes new surfaces where other organisms can take hold. The more marine life on a hardground, the more fish it will attract.

Although the maps that the researchers will produce from these studies aren't likely to excite those looking for ready-made treasure, they will pinpoint prime fishing areas for anglers, and potential sources for tomorrow's minerals.

Photo by Kathy Hart



Scott Snyder

FOSSIL FINDS

COLLECTING HISTORY

Peter Harmatuk of Bridgeton scooped up a handful of dirt, sifted it through his fingers and picked out a pointy gray shark's tooth. "This is from a sand shark. It's about 10 million years old," he says, examining it with the casual eye of an expert who'd seen others like it a thousand times.

For nearly 28 years, Harmatuk has been digging up history in North Carolina, helping to piece together the puzzles of its past. His findings, and those of other fossil hunters, provide important clues to the weather conditions, rock formations and animals that existed in the area over a 20 million-year period that spanned four geologic formations (Pungo River, Yorktown, Croatan and Post Croatan).

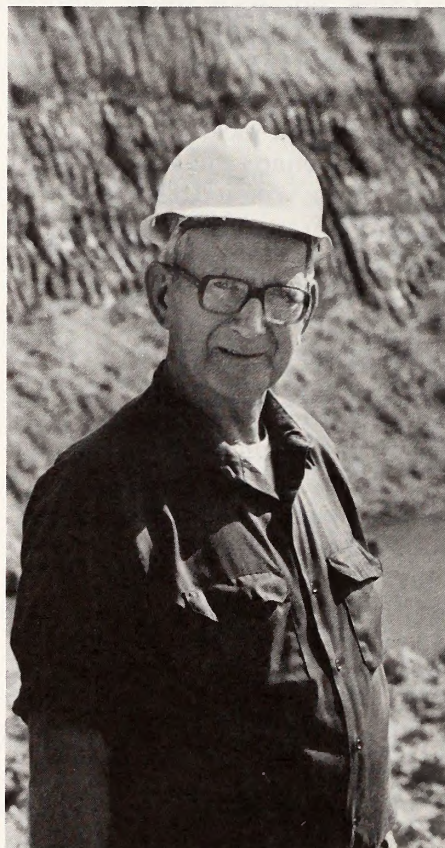
Harmatuk spends most of his time sifting through the rubble at the Texagulf Chemicals Co. in Aurora. In this canyon-sized pit in eastern North Carolina, the petrified remains of hundreds of species of fish, shellfish, plants and animals lay scattered across the dirt like toys in a game room.

The mine, in a way, is a collector's playground. Harmatuk says 85 million sharks' teeth are dug out of the dirt in a 24-hour period. And since the mine opened in the early 1960s, 70 different kinds of fish, 24 kinds of porpoises and 24 species of birds have been uncovered.

"We keep finding new stuff all the time," says Harmatuk. Just recently, collectors found new whale and porpoise species.

Of the 2,300 feet of sedimentary layers in Aurora, only the first 100 feet are exposed in the pit. Most of the fossils uncovered are from the Pungo River

Photo by Sarah Friday



Peter Harmatuk

formation and later, says Rusty Walker, former manager of public affairs for the N.C. Phosphate Corporation in Aurora.

In the Pungo River formation, most evidence reveals bottom dwellers like worms, clams, brachiopods and shrimp-like animals, says Walker.

What collectors have found are many prototypes of animals we know today. Fossils of primitive whales and dolphins with their neck vertebrae not fused are typical of the Pungo River formation.

In terms of variety, the Yorktown layer is the richest, says Harmatuk. When the ocean covered eastern North Carolina 5 million years ago, conditions were hearty for all kinds of life. As a consequence, many of the fossils found in the 50-foot Yorktown layer represent land and water animals that still exist. Very few plants survived because they were so fragile.

"I found a giant tortoise (fossil) a few months ago," says Harmatuk. "It weighed about 700 pounds." He's also discovered remnants of sharks, whales, porpoises, fish, walruses, elephants, horses, camels and birds—rare birds, he says,awks mostly and some buzzards. "I found a bird that was essentially complete, and it had its last meal in its stomach—fish bones."

After all these years, Harmatuk still frequently finds a surprise buried beneath the soils. He's dusted off the fossilized remains of tapirs (hoglike mammals), manatees and crocodiles. And even the Smithsonian Institution doesn't believe he found pieces of volcanic rock. "They say it shouldn't be here, but it is," he says. One possible explanation is that it floated across the Atlantic Ocean.

Many of Harmatuk's treasures are on display at the Aurora Fossil Museum, which opened in 1978. The museum shares the secrets of fossils once locked in the earth's crust. When revealed, their messages are clear.

"They let us know how the earth was formed," says Walker. "If we look at fossils, we can see what conditions were here. And the same geologic forces are at work today."

—Sarah Friday

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



An accidental plunge into cold winter waters can be life-threatening, no matter how well you swim. The loss of body heat is probably the greatest hazard because water cools the body 25 times faster than cold air. Within 10 to 15 minutes, the temperature in your body's core—the brain, heart, lungs and other vital organs—begins to cool, producing a condition known as hypothermia.

Signs of pain, tiredness, poor coordination, numbness, poor speech and mental confusion appear. When the body's core temperature falls below 90°F, the victim becomes unconscious. At 85°F, heart failure occurs.

How fast does all this occur? The answer depends on several factors including water temperature, body size, body fat and activity in the water. Whatever the factors, there are some steps you can take to improve your chances of survival until you're rescued.

Don't swim. A person cools 35 percent faster by swimming. Instead, move just enough to keep your head and neck above water. If you're wearing a life vest, assume the fetal position, or if there is another person in the water, huddle together. And, keep a positive attitude about your rescue. A will-to-live can make a difference.

To treat a hypothermia victim, re-warm him carefully. Do not massage his arms or legs since cold blood could flow to the core, further lowering the body temperature. Apply warm, wet towels to the head, neck, groin, chest and abdomen. Even if a victim ap-

pears drowned, administer heart massage and mouth-to-mouth resuscitation. Transport the victim as soon as possible to a hospital.



The idea of air freighting seafood is taking off in North Carolina. With new markets opening across the country and overseas, shipping by air ensures the product will reach its destination fast and fresh—and still net the dealer a profit.

A new Sea Grant *Blueprint*, "Air Freighting Seafood from Coastal North Carolina," gives detailed suggestions for packaging and shipping fresh fish and shellfish. Written by Gary Van Housen, Sea Grant's seafood marketing specialist, the *Blueprint* includes information on shipping containers, packaging materials, airline regulations and costs. It also lists cities having airports with refrigeration facilities and companies distributing packaging materials.

For a free copy of Van Housen's *Blueprint*, write UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605. Ask for UNC-SG-BP-85-4.

UNC Sea Grant has been awarded \$1,250,000 in federal funds for 1986 by the National Sea Grant College Program, which is part of the National Oceanic and Atmospheric Administration. The funds will support the second year of UNC Sea Grant's three-year approved grant cycle.

Why do sport fishermen prefer to catch a grouper rather than a triggerfish, a snapper rather than a jack crevalle? It's all in how they perceive the fish, say Jeff Johnson and David Griffith, Sea Grant researchers at the Institute for Coastal and Marine Resources at East Carolina University.

In a new Sea Grant publication, *Perceptions and Preferences for Marine Fish: A Study of Recreational Fishermen in the Southeast*, Johnson and

Griffith describe the results of a study that was designed to find out why fishermen favored some species of fish over others.

The results are already being used to change recreational fishermen's minds about some misunderstood species—bonito, shark, jack crevalle, triggerfish and more.

For a copy of this publication, write UNC Sea Grant. Ask for UNC-SG-85-01. The cost is \$3.75.



For every snapper, grouper and king mackerel a recreational fisherman has pulled in, you can bet he's probably cast aside an amberjack, triggerfish or shark.

Why? Well, it's not because these fish aren't just as good to eat. More than likely, the fisherman just doesn't realize that amberjack can be just as tasty as king mackerel.

To help some of these fish shake their poor image and to ease the pressure on more popular species, Sea Grant Marine Advisory Service Director Jim Murray and East Carolina University anthropologists Jeff Johnson and David Griffith have developed a series of 10 colorful brochures. Each contains information on catching, cleaning and preparing an underutilized species. Amberjack, triggerfish, skates and rays, sharks, sea robin, sheepshead, bonito, panfish, jack crevalle and croaker are featured. And, several recipes are included for each species.

The brochures were designed to complement a National Marine Fisheries Service study in which the researchers examined why anglers prefer some species of fish over others. They found that recreational fishermen reject fish they perceive as ugly, difficult to clean, dangerous to handle and poisonous. Often, this rejection is based on hearsay and rumor, rather than actual experience.

For a free copy of the brochures, write Sea Grant. Please specify which

Continued on next page

brochures you want: amberjack, UNC-SG-85-09; sea robin, UNC-SG-85-10; skates and rays, UNC-SG-85-11; triggerfish, UNC-SG-85-12; panfish, UNC-SG-85-13; jack crevalle, UNC-SG-85-14; sharks, UNC-SG-85-15; sheepshead, UNC-SG-85-16; bonito, UNC-SG-85-17; and croaker, UNC-SG-85-18. Retailers who would like multiple copies of the brochures can contact the Sea Grant office for more information.

UNC Sea Grant has just published a new listing of all of its popular booklets, brochures and pamphlets. Although the titles (*How to Build a Crab Pot* or *Building and Stabilizing Coastal Dunes with Vegetation*) have yet to appear on the *New York Times* Best-seller List, they are publications that can help you work, play and live better in coastal North Carolina.

From seafood selection to hurricane preparation, Sea Grant offers the public a variety of free or modestly priced publications on coastal topics. For a copy of this publications brochure, write UNC Sea Grant.



A new Public Broadcasting Service television series will explore the history of our 4½ billion-year-old planet Earth. The seven-part series, *Planet Earth*, will premiere Jan. 22, at 9 p.m. EST. Visit an erupting volcano, dive to the bottom of the Atlantic aboard a submersible craft, hop aboard the space shuttle, and take a voyage to other planets.

The one-hour programs reveal scientific insights and discoveries of the past two decades. Internationally known scientists share their theories about the formation of the earth, its oceans and climate, and the universe beyond.

Planet Earth was produced by WQED/Pittsburg, renowned for its *National Geographic* series, in cooperation with the National Academy of Sciences.

Gary Van Housen, a Sea Grant marine advisory agent at Bogue Banks, is leading a series of seminars across the state for seafood retailers. Upcom-

ing sessions will be held in the Greensboro/Winston-Salem area and in the Charlotte area.

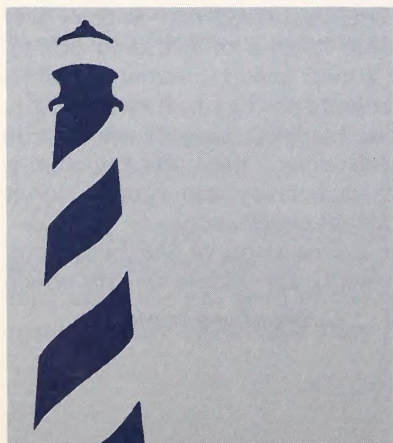
Van Housen says the seminars have something for everyone from seafood counter clerks to meat department personnel who handle seafood. He and a panel of instructors will cover topics such as advertising and promotion, quality in seafood, nutritional value of seafood, purchasing guidelines, demographics, and management of a retail market. For more information, contact Van Housen at 919/247-4007.

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COASTWATCH



FISH ON THE MOVE

To biologists, they're pelagics. To fishermen, commercial and recreational alike, they're king mackerel, bluefish, dolphin, wahoo—fish that swim the near-shore waters of the coast and fish that cruise the deeper waters near the Gulf Stream.

Simply defined, pelagic (pe-laj'-ik) species of fish are ocean-going; they like the open waters of the sea. For fishermen, these species often mean a hefty catch that offers a good fight as well as good table fare. But

for fisheries managers, pelagic species pose a set of problems different from reef fish or inshore species.

This month, *Coastwatch* takes a look at pelagics—their biology, the inherent management problems they pose and how the state is dealing with those problems. And, *Coastwatch* takes you aboard a commercial fishing boat in pursuit of king mackerel, one of the most popular pelagics.

Continued on next page

Pelagic species are often divided into two categories—coastal pelagics and oceanic pelagics—according to their preference for habitat, says Charles Manooch, a research biologist with the National Marine Fisheries Service in Beaufort.

Coastal pelagics, including such species as king and Spanish mackerel, little tunny or false albacore, bluefish, Atlantic bonito and cobia, generally inhabit waters up to about 10 miles offshore.

Their distribution off the North Carolina coast is influenced by water temperature and the availability of food, says Manooch, also author of *Fisherman's Guide: Fishes of the Southeastern United States*. During the spring and fall when smaller food fish are most plentiful, fishermen are more likely to net or hook a coastal pelagic. The exception, bluefish, can be caught year-round off the North Carolina coast, although fall is the most likely time to hook the larger bluefish.

Further offshore, the "blue water" of the Gulf Stream is home to oceanic pelagics such as yellowfin and blackfin tuna, skipjack, dolphin, wahoo, white and blue marlin, and some bigeye and bluefin tuna. "Most of these species are available when they move up onto the continental shelf in the vicinity of the inner edge of the Gulf Stream," says Manooch.

Most pelagics, coastal and oceanic, travel in schools and are a highly mobile set. Like geese, they move south in fall and winter and north in spring and summer. A king mackerel lucky enough to elude North Carolina fishermen during the fall fishing season might spend his winter off of Florida. He prefers to reside in waters that are 68 degrees or above.

Generally, pelagics mature quickly and live short lives. They produce many eggs, but experience high annual mortality rates, says Manooch. Most of the

species spawn offshore, and for the most part their young mature there.

At certain times of the year, in some locations, North Carolina's coastal waters are pelagic paradise for fishermen. The larger fish often gather around inlets and capes, anxious to feast on the tremendous variety of foods there. With the same idea in mind, the state's fishermen flock to the coast, cast out a baited line, and hope to fool a hungry fish into biting the hook.

"Hatteras and Oregon Inlet in particular are ideal for both coastal and oceanic pelagics," Manooch says. And since the Gulf Stream is much closer to the coastline in the northern part of the state than in the central and southern portions, more boats in the Oregon Inlet and Hatteras area fish for pelagic species.

Voracious eaters, pelagics are known to consume "anything that is easy to get," says Manooch. Generally, they are piscivorous, or fish eaters, preferring small anchovies, silversides, sardines and squid or small shrimp and crabs. "The availability of pelagics depends on the availability of forage fish," says Manooch.

And when such a meal is readily available, pelagic species sometimes go into "feeding frenzies." As an example, Manooch refers to a "blues blitz."

"I've seen a school of bluefish follow a school of menhaden, and move them into shoals between bars and the beach. I've seen menhaden on the beach, cut and scarred to pieces, and others just gasping on the beach," says Manooch.

With a reputation like that, bluefish and other pelagics are popular targets for fishermen. It's that hope of tossing a line into a school of those feeding fish that keeps anglers flocking to the North Carolina coast.

— Nancy Davis



North Carolina's coast — a pelagic paradise for fishermen

Managing the Stocks

Used to be a fisherman could ride offshore and snag all the kings or blues he could carry home. But time, fishermen and new technologies changed things. Some species are running in short supply and need to be managed. For the managers, this isn't an easy job, especially when it comes to pelagic fish.

The very nature of these open-water fish makes them difficult to study and to regulate. "Generally, species like coastal pelagics are not as apt to be over-exploited," says Charles Manooch, a research biologist at the National Marine Fisheries Service in Beaufort. "They produce a lot of eggs and the whole stock turns over quicker."

But pelagics don't play by the rules. "The loophole is that these fish school," says Manooch. That makes them easier for fishermen to spot, target and catch.

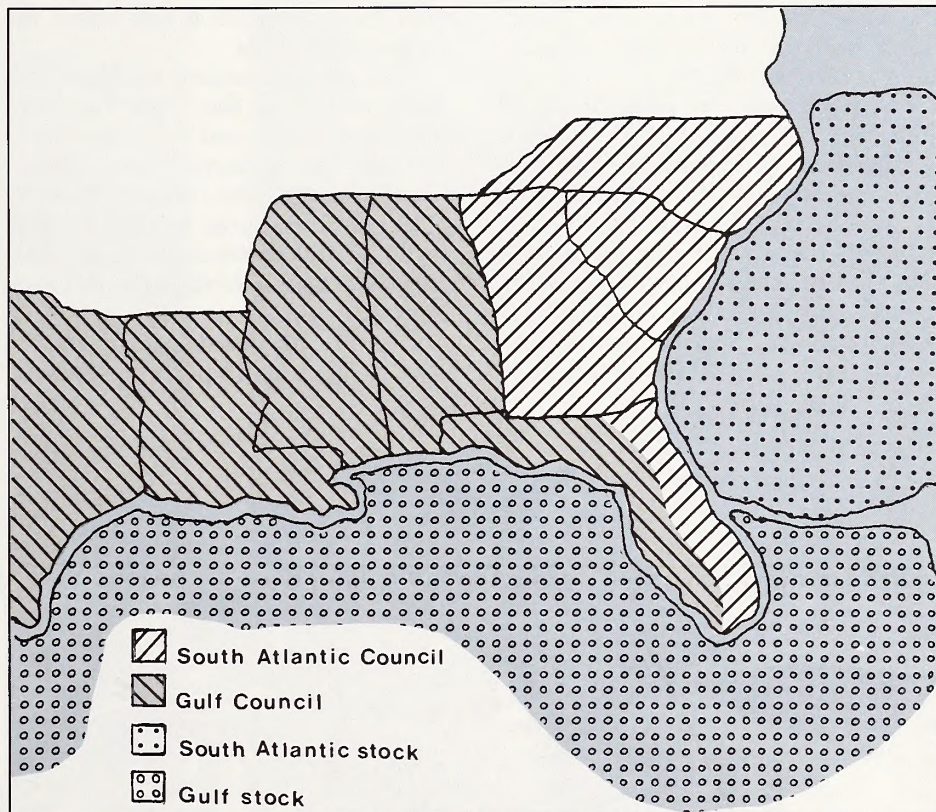
To make matters more difficult, there may be several stocks within one species that travel in different areas, adds Manooch. A stock is a population of fish that migrates together and that is reproductively and genetically different from another population of the same species.

Most of the conflict for managers comes when pelagics cross state lines. Species like mackerel, tuna and marlin rove about the coast like nomads on an offshore interstate.

Unlike blue crabs and clams, most pelagics wander in and out of state boundaries as they please in search of suitable feeding grounds and waters. The N.C. Division of Marine Fisheries monitors and regulates fish and shellfish from the state's sounds to three miles offshore.

But who governs the roaming pelagics beyond the state's boundary lines? And how can the fisheries be controlled equally between the states?

In general, the federal government



November to March, boundaries for the Atlantic stock of king mackerel extend to mid-Florida. April to October, the fish migrate to Florida's southern tip.

regulates the area called the Fisheries Conservation Zone, which lies three to 200 miles offshore. Enforcement powers are shared by NMFS, the U.S. Coast Guard and state fishery programs. Trying to outline the jurisdiction of each is like getting caught and tangled in a gill net.

To untangle some of the confusion, especially with the pelagic fisheries, a regional management system was created in 1976 by the Magnuson Act. Administrators realized such a program was needed to deal with the varied and biologically complex fisheries. That year, eight councils under NMFS were started to carry out this plan. Now, North Carolina joins South Carolina, Georgia and Florida to make

up the South Atlantic Fisheries Management Council.

Its members work alongside the Gulf and Mid-Atlantic councils to make decisions on seasons, gear types, license fees and recreational and commercial catch limits. When the group was established, the members intended to divide the species according to regions, but because fish know no boundaries this couldn't be done perfectly, says Jim Murray, director of UNC Sea Grant's Marine Advisory Service.

When fishing trends suggest that a species within a region or across regions is declining, NMFS investigates for proof. With pelagics, this can be a

Continued on next page

difficult job. The best indicator available at this time is catch data from surveys of commercial and recreational fishermen, says Manooch. The council devises its management plan based on research statistics, public hearings and member concerns.

In the South Atlantic region, the council has been keeping close watch on pelagics such as billfish, tuna and mackerel and has imposed some regulations. Currently in North Carolina, the managers are most concerned about king mackerel, a species important to both the recreational and commercial fishing industries.

The populations of king mackerel flourished for years, but so did their popularity with fishermen. And in a few years, the stocks dwindled from the Northeast to the Gulf.

"About three years ago we thought that all the mackerel were one big group," says Jim Bahen, the Sea Grant Marine Advisory Service agent at Kure Beach. But recent studies determined

two separate fish stocks traveled the coast—one from Virginia to the east coast of south Florida and the other from there to Texas.

In the Gulf, hook and line commercial fishermen caught so many king mackerel in 1983 that they met their quota of nearly 4 million pounds set by the South Atlantic and Gulf councils in just nine months. Until the next season, commercial fishermen could not fish for mackerel with hook and line, and recreational fishermen could not sell their catch because it fell under the commercial quota.

"There's still a serious problem with management in the Gulf, but here we've realized it, and we're starting to manage our resource," says Bahen. The South Atlantic council set an 11 million-pound quota in 1985 for recreational and commercial king mackerel fishermen fishing in the three- to 200-mile zone.

Recently, the council proposed to cut this quota by 18 percent. The new

regulations, scheduled to go into effect April 1, would allow recreational fishermen approximately 6 million pounds and commercial fishermen 3 million pounds. In addition, the council suggested bag limits of three fish per person per trip for private and charter boats or headboats traveling in the Fisheries Conservation Zone.

To come up with such a package plan, it took time, research and some give and take from the fishermen and the council members. "It's kind of difficult when you're trying to regulate something from Florida (to Virginia), but you try to look over your own interests," says Bob Mahood, director of the South Atlantic council and former director of DMF. "We tried to work it out where it's fair to everybody."

Each state in the region has the option to comply with these regulations within their three-mile jurisdiction, says Ernest Carl, a member of the council from North Carolina. So far, Florida has been the only state in the South Atlantic region to adopt these measures.

The change isn't always easy to take. Charter boat captains who cruise the Fisheries Conservation Zone are worried sport fishermen won't take as many trips because of the bag limits, and tournament officials are concerned the commercial quota for that area may be met before fall or winter tournaments can be held. If the commercial quota is reached, any king mackerel caught beyond the three-mile limit in a tournament cannot be sold as is usually done to offset tournament costs.

But Bahen believes short-term management may lead to long-term prosperity in the mackerel fishery.

"We're going to have to manage our resource," he says. "We're going to have to fish for today and save some for tomorrow, take more of a conservation view."

"A good example is if you look back at the striped bass. That is a fishery they let go too far. It got to the point where there weren't any fish at all. It got so bad, some states put a moratorium on it." But as with king mackerel, the councils are trying to do something beforehand.

"It's a big pill for some people to swallow, but they're going to have to choke it down," says Bahen.

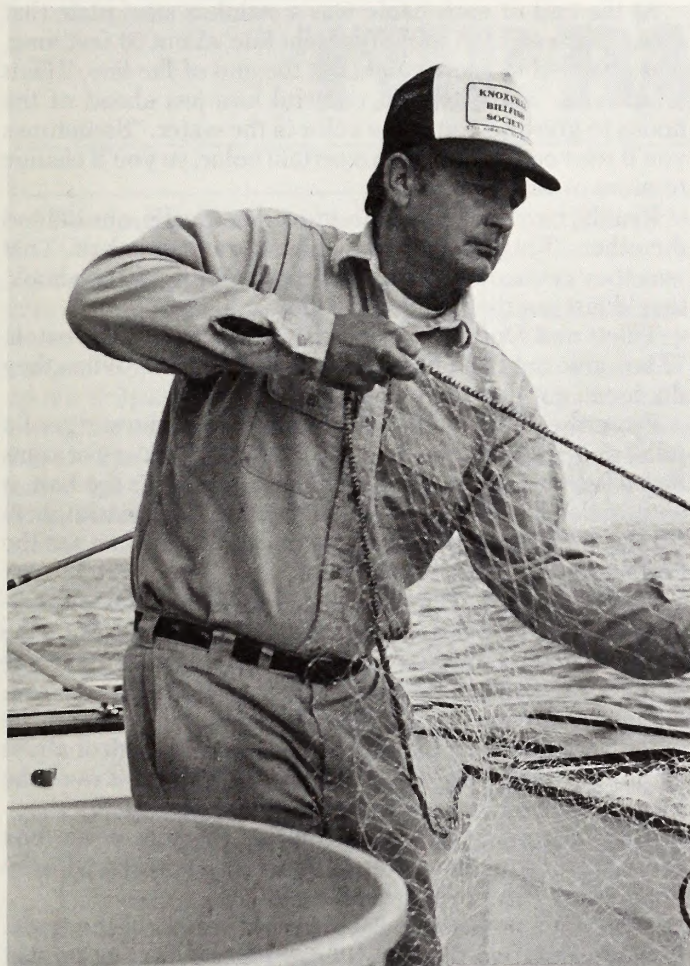
Photo by Joel Arrington



Fishermen reel in a wahoo

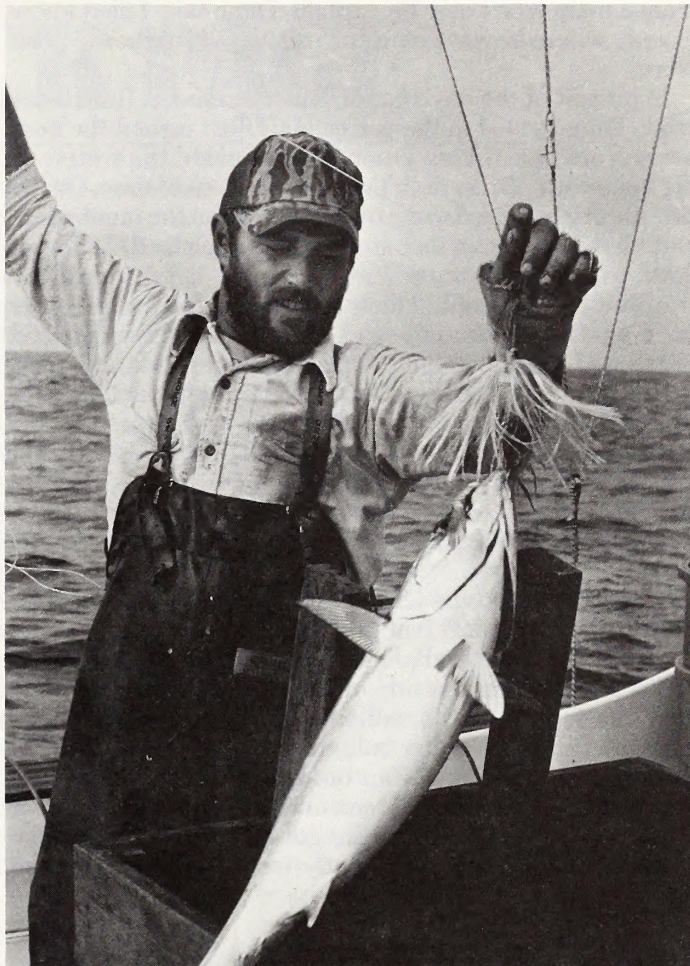
— Sarah Friday

Photo by Nancy Davis



Tony Tillett

Photo by Nancy Davis



Charlie Dunn

A day with the kings

Captain Tony Tillett guided his 53-foot *Carolinian* through the rough surf at Oregon Inlet at 6:30 on a mid-November morning. The sun was just peeking from behind the horizon. "We're late," he said. "Everybody else has already gone."

About half a mile offshore, fishermen on eight other boats had already set out their nets for bait fish. Along with the others, Tillett and mate Charlie Dunn were commercial fishing for king mackerel. They had finished their charter season a couple of weeks earlier. Now, whatever they caught was theirs, and it had to be enough to pay for their expenses in fuel, equipment, bait and ice.

Tillett descended from his perch on the bridge where he was guiding the boat. The two men set out a gill net, let the boat drift away, then returned to the net several minutes later. No, the mackerel weren't this close to shore, Dunn said. They were fishing for "fatbacks. You know, menhaden," he said.

As soon as the fishermen emptied their nets, moved the boat and set them out again, Dunn began preparing the bait. Eviscerated fish would stay fresher longer, he said. "And

the fresher the bait, the better the chance to catch fish."

As the other boats pulled in one last netful of bait fish, a neighboring fisherman pulled his boat alongside the *Carolinian* and donated an extra bucketful. "We all work together out here," explained Tillett. In all, Tillett and Dunn began fishing with about 30 pounds of bait.

Dunn hauled in the nets, and they set off for what Tillett had determined to be the day's fishing grounds, an area of water about 10 to 15 miles offshore.

Around the docks, some folks say Tillett is one of the best fishermen in northeastern North Carolina. Dunn agrees, but Tillett is more modest. No matter how much you know about fishing, he said, there will still be days when you pull your boat into the docks with an empty hold. "A fish is so unpredictable. You'll get fooled from time to time."

But during his 10-hour workday, Tillett's experience helped reel in 51 king mackerel, ranging from 10 to 15 pounds each—as much as anybody else caught that day, even if he did get a late start. To the untrained passenger, Tillett appeared to wander aimlessly across the ocean. But

Continued on next page

from a mate who knew his captain, Dunn said Tillett knew exactly where he was going and exactly where those 51 fish were.

In pursuit of the day's catch, Tillett served as fish-finder while Dunn reeled in the prizes. As Tillett turned the boat away from bait-fishing grounds and toward the waters of the bigger fish, Dunn didn't waste a moment of time. On the ride out, he trimmed some of the flesh from the menhaden, cutting the bait into 6-inch strips. Dunn explained, "They've gotta wiggle in the water."

About 10 miles out, Tillett descended from the bridge once again, this time to ready his downriggers and rod planers—fishermen's lingo for two types of rods and reels. If they didn't use specific names for the equipment, he said, it would be difficult to let other fishermen know which method was working best. Throughout the trip, Tillett continually exchanged such information via his radio with other fishermen on the water that day. "If I catch a fish on a downrigger at 50 feet, they know what I'm talking about," he said.

Tillett explained the terms. A downrigger uses a shorter line, usually 50 to 125 feet of cable, and is fished over the stern of the boat. A rod planer uses about 300 feet of cable and is fished from the side of the boat. A fisherman may vary the length of the cables according to where he is catching fish in the water column.

"Some days we might start out with (a downrigger at) 50 feet and the other one 100 feet, and keep trying to figure it out," said Tillett. This day, he got lucky. His first choice worked, and the fish consistently went for the bait on the downriggers set at 50 feet.

Photo by Nancy Davis



Dunn cleans the catch

At the end of each cable was a stainless steel plate that acted as a weight. A monofilament line, about 50 feet long, was attached to each weight. At the end of the line, Tillett attached a "sea witch" or colorful lure just ahead of the hooks to give the bait some color in the water. "Sometimes you'll start catching fish on a certain color, so you'll change to more of that," he said.

Finally, two hooks were positioned vertically, one behind the other. "King mackerel always cut the bait in half. That way they get hooked on the back hook. With only one hook, they'd just get the bait," said Tillett.

Tillett and Dunn used electric reels to pull in the catch. "They give out from time to time," Tillett said. "When they do, it can cut the catch in better than half."

From the deck, Dunn watched for the slightest dip of a pole, and from above, Tillett scanned the water for signs that a fish had struck the bait. "When a fish hits the bait, it automatically trips the weight and makes it come straight in (to the surface). There's no friction at all. You can see the line start coming up," said Tillett.

Within minutes, Tillett motioned to Dunn, who immediately flicked the switch on one of the downriggers. Soon the day's first king mackerel skimmed the water's surface behind the boat. As the weight neared the top of the rod, Dunn flicked the switch off. Then, hand over hand, he pulled in the 50 feet of monofilament line. As a fish of about 10 pounds rose from the water, Dunn flipped it over the stern of the boat into a box prepared for the catch.

A metal rod, or de-hooker, across the top of the box allowed Dunn to remove the hook without tangling with the floundering fish's row of sharp teeth.

Tillett let a novice in on some other secrets of the trade. "If you catch two fish at a time, you start circling on that spot. We also use Loran. When we hit the fish, we look at those numbers and try to stay on that spot."

Tillett also kept a watchful eye on a temperature gauge on his boat. Temperatures averaged from 65 to 75 degrees. King mackerel prefer 68- to 70-degree waters, he said. But then again, you might catch them in 64- to 70-degree waters. You just never know.

A fathometer helped Tillett know how deep the water was and what the bottom looked like. It also showed evidence of small bait fish that the larger mackerel might feed on.

"A king mackerel moves with the wind and the currents," said Tillett. "The wind and currents move the bait and the mackerel usually move with the bait." Therefore, Tillett kept the boat moving with the current rather than against it.

By the end of the day, aside from several sharks and an albacore, Tillett and Dunn reeled in more than enough to pay for the day's work. At that time, king mackerel were bringing about \$1 per pound at the docks. Just two weeks later, fishermen were catching 18- to 25-pound king mackerel, and the price had dropped to 80 cents per pound. Tillett said, "The more you catch, the less you get for them."

And the line between spending money and making money is a fine one on the water. Tillett figured his boat used about 90 gallons of diesel fuel at \$1.25 per gallon. And you have to add in costs of broken lines, torn bait nets and wear and tear on the boat, he said.

"Some days you work all day just to pay for the fuel," said Dunn.

— Nancy Davis

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



There's never a better time for gazing up at the stars than a cold, clear winter night. And if you happen to be at the coast, you have an even better chance at a good

view of the constellations, says Mark Joyner, education specialist for the N.C. Office of Marine Affairs.

"The coast is a very good place for stargazing because you certainly don't have lights coming in from out at sea—especially if you're lucky enough to get out in a boat and get away from the coast so the lights coming from the cities and towns don't interfere with your stargazing," says Joyner.

You don't have to be an expert astronomer to enjoy the sights in the sky. Joyner recommends a star guide for beginners and a pair of binoculars; a telescope isn't necessary. Before long, you'll be able to find your way around the night sky.

Joyner says you can begin with a few well-known constellations such as the Big Dipper and Orion. "With just a few major constellations, we can find our way around," he says. "We can tell direction. We can tell the season of the year. And in fact, early navigators used the stars for directions and finding their way across vast stretches of ocean."

A guide to assist landowners with coastal development projects is available from the N.C. Division of Coastal Management. *A Handbook for Development in North Carolina's Coastal Area* is a guide to the permit program of the

Coastal Area Management Act. It includes where and when a CAMA permit is required, how to apply for a permit, the standards that are used to review a permit application, and how those standards are used to protect the public interest in the coast.

Coastal Management officials say that by following the standards outlined in the book, you will protect the quality of North Carolina's estuarine and barrier island resources so that they can continue to support the diversity of life in the coastal area.

For a free copy of the book, write to the Division of Coastal Management, NRCD, P.O. Box 27687, Raleigh, N.C. 27611-7687, or call 919/733-2293.



For Lundie Spence, teaching marine science doesn't take a classroom and a blackboard. Instead, she uses a trunk full of activities and a good dose of enthusiasm to spread her knowledge of the coast throughout the state. Recently, the North Carolina Science Teachers Association recognized Spence's efforts as UNC Sea Grant's marine education specialist by presenting her the "Distinguished Service Award" for 1985. This award, the second given by the NCSTA, honors one educator who is not affiliated with a school system but is supportive of the education process. Judy Spitsbergen, curator of education at the N.C. Maritime Museum in Beaufort, received last year's award. The NCSTA presented Spence with a plaque at the annual conference, which met in Raleigh Nov. 7 to 9.

Marine advisory agent Bob Hines is gearing up for the sixth annual Commercial Fishing Show. This year the show, which is free to the public, will be held March 14 to 16 at the Crystal Coast Civic Center in Morehead City.

Dealers and manufacturers will display the latest in fishing boats, nets, motors, traps, pots, engines and accessory gear. And seminars will be of-

fered on topics such as shrimping, hydraulics and aquaculture.

The show is cosponsored by UNC Sea Grant, the Carteret County Watermen's Association, and the N.C. Agricultural Extension Service. Merchants interested in participating should contact Hines at 919/247-4007.



Chart your course to spend a day at the Southern Sport and Outdoor Show April 4, 5 and 6 at Raleigh's N.C. State Fairgrounds. This year, the show will feature an

expanded exhibit focusing on salt-water sport fishing. UNC Sea Grant, the Crystal Coast Charter Boat Association and the Carteret County Sportfishing Association will sponsor booths displaying sportfishing gear and equipment. In addition, you can learn how to charter a boat or fish offshore in a series of seminars offered on topics relating to sport fishing. Bob Hines, Sea Grant's Marine Advisory Service agent at Bogue Banks, is coordinating the sportfishing groups and seminars for the show.

For more information, or if you would like to have an exhibit at the show, write Hines at UNC Sea Grant, Box 896, Atlantic Beach, N.C. 28512. Or call, 919/247-4007.

Rich Novak, Sea Grant's marine recreation specialist in Manteo, is helping the N.C. Marina Association establish a quarterly newsletter, *Marina Messages*. The newsletter will include a legislative update, a calendar of events, a message from the association president and other news pertaining to the marine trades industry.

Although the newsletter is written especially for marina operators, others interested in this industry can subscribe to this free newsletter. To receive a subscription, write Novak at the N.C. Marine Resources Center on Roanoke Island, P.O. Box 696, Manteo, N.C. 27954.

Continued on next page



Meet the Sea Grant team. Howard Kerby in the laboratory as he genetically manipulates fish stocks. Bob Christian, Hans Paerl and Don Stanley as they test the waters for blue-green algae. Lundie Spence as she ignites the marine education fire. These Sea Grant team members and others are pictured in the pages of *Sea Grant in North Carolina 1983-1984*, the program's biennial report.

The 40-page report covers two years of Sea Grant research and Marine Advisory Service efforts and accomplishments. You'll learn how researcher Mark Sobsey perfected his method for detecting hepatitis A in shellfish, how food scientist Tyre Lanier developed an edible minced fish product from the lowly menhaden, and how advisory agent Wayne Wescott helped the soft-shell crab business boom in northeastern North Carolina.

For a free copy of this report, write UNC Sea Grant. Ask for UNC-SG-85-05.

Joyce Taylor, Sea Grant's seafood agent at the NCSU Seafood Laboratory in Morehead City, has received an award from N.C. State University for distinguished performance. Taylor was among 23 recipients of the award this year. In a letter to Taylor, J.E. Legates, Dean of the NCSU School of Agriculture and Life Sciences, commended Taylor for her "dedicated service to the university."



Each year, thousands of North Carolinians enjoy reeling in catches on the state's 34 fishing piers. And these piers contribute significantly to the local economies where they are located.

For years, the pier owners have grappled with the idea of improving pier fishing by concentrating fish near the pier. But traditional artificial reef development hasn't been feasible. In 1984, Sea Grant Marine Advisory Service Director Jim Murray and UNC at Wilmington biologist David Lindquist

tested a new idea in artificial reefs. They placed fish aggregating devices, or floating reefs, off of piers at Wrightsville Beach.

Murray and Lindquist gathered data for each pier before and after the devices were installed. Now, the researchers have published their findings in a report, *The Use of Midwater Fish Aggregating Devices to Attract Marine Fish at Two North Carolina Fishing Piers*. For a copy of the report, write Sea Grant. Ask for UNC-SG-WP-85-1. The cost is \$2.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, NC 27695-8605. Vol. 13, No. 2, February, 1986. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

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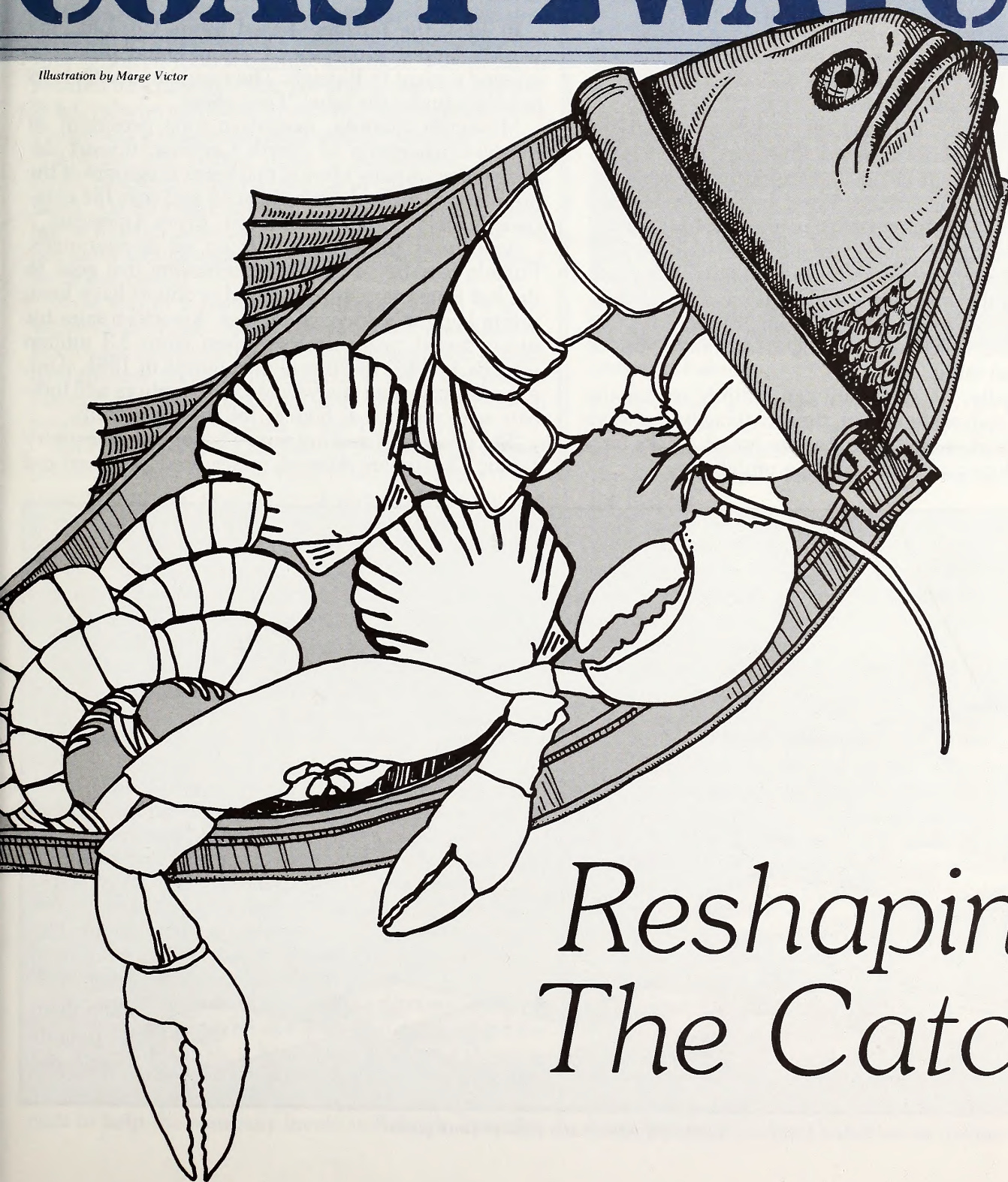
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COAST WATCH

Illustration by Marge Victor



*Reshaping
The Catch*

A YEN FOR IMITATION SEAFOOD

By Nancy Davis

The label on the box says "imitation crab meat." But inside, the product looks like crab meat, has the texture of crab meat, and it tastes, well, almost like crab meat.

Instead, it's a pseudoshellfish made from surimi (sur e' me), a minced fish product developed by the Japanese. The fish is processed into a paste that serves as the base for restructured seafood products, or analogs. Just add a little of the real thing for flavor and, voila—crab legs, scallops and lobster tails.

So far, it seems Americans don't mind a little Japanese ingenuity making it to the dinner table. In fact, consumer taste buds are giving the products positive reviews, and folks are gobbling down the imitations like the real thing.

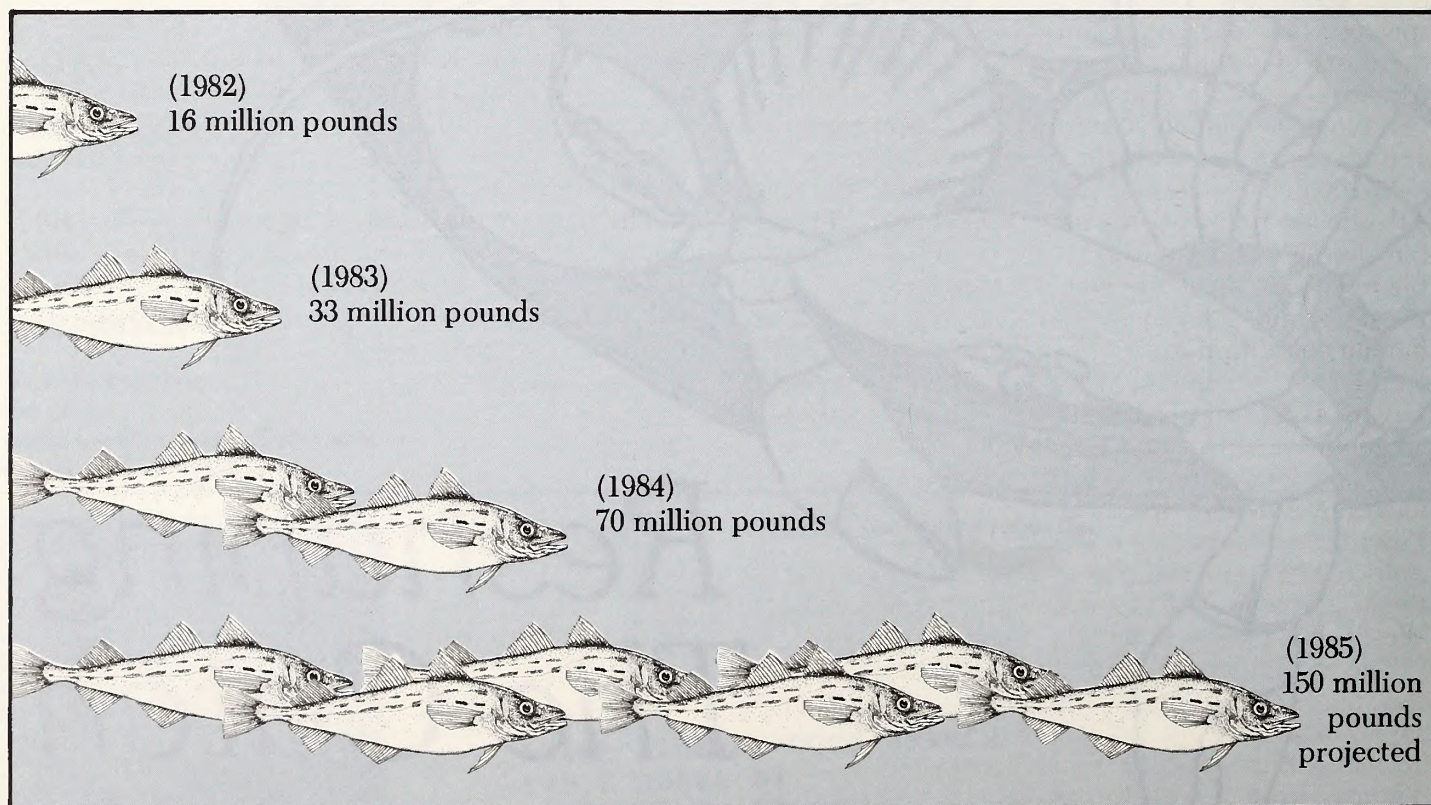
Admittedly, no substitute can entirely match the flavor of fresh seafood. But, the real thing isn't always available and, sometimes, the expense of Alaska king crab, scallops and lobster can be prohibitive.

In 1984, the Japanese-based Kibun Co. Ltd., the world's largest processor of surimi-based products, opened a plant in Raleigh. The company markets its products under the label "DelicaSeas."

Masayuki Fukuda, executive vice president of Kibun Corporation of North Carolina, doesn't describe his company's target market as a segment of the population. Instead, Fukuda grins and says the company wants its products to reach "every American."

Ambitious perhaps, but from all appearances, Fukuda may be on his way to achieving that goal. In the last four years, surimi-based products have been riding high on a wave of success. American sales for surimi-based products have risen from 3.3 million pounds in 1980 to 70 million pounds in 1984. And, experts project an analysis of 1985 numbers will indicate sales reached as high as 150 million pounds.

The process of making surimi began in 15th century Japan. The fish are skinned, eviscerated, deboned and



American sales of surimi-based products increased almost ten-fold in four years

washed, and sugar and sorbitol are added. The resulting product is surimi, a protein concentrate that is white, odorless and flavorless. Finally, the surimi is frozen in blocks for storage.

In this form, the surimi is without food value. It's what happens next that transforms the commodity into something consumers will buy and eat.

The surimi is chopped and natural shellfish flavorings are added. Then the mixture is extruded or molded into shapes, similar to the natural counterparts, and cooked.

Why are Americans so taken with an imitation product? It's possible that they see the same attributes that first captured food scientists' attention. The surimi is molded into products that are high in protein and low in fat, calories and cholesterol. And, the products offer consumers a consistent, high quality product.

Another big selling point is economics. Surimi-based products sell for a fraction of the cost of the real thing. Alaska king crab legs, for example, were retailing in Raleigh supermarkets in January for about \$10 per pound. But the simulated crab legs retail for about \$4.50 per pound.

Most surimi is made from Alaska pollock, a lean, white-fleshed fish that is abundant and inexpensive. Each year an estimated 3.7 billion pounds are caught by Japanese trawlers in Alaskan waters, shipped to Japan to be made into surimi, and the surimi or surimi products are shipped back to the United States.

Now, with the development of a surimi-based food product industry on the East Coast, researchers are investigating the possibility of using an Atlantic fish species as a resource for surimi production to lessen the costs of shipping surimi from Japan or Alaska. Already, Sea Grant researchers at N.C. State University have developed a surimi from menhaden, an abundant fish found off the North Carolina coast.

Menhaden processing companies along the mid-Atlantic are following the new technology as a possible alternate outlet for their catches. It may be possible to elevate the lowly menhaden from a source for livestock and chicken feed to a quality product for human consumption.

At Kibun, Fukuda says his company would consider buying American-produced surimi, providing there is an adequate supply and a consistent high quality.

If there is no surimi production here, why did Kibun locate in Raleigh? Speaking through an interpreter, Fukuda said the area was chosen because of its proximity to Sea Grant researchers at NCSU and its attractiveness as an East Coast distribution point. (Kibun's West Coast plant is in Seattle, Wash.)

The availability of labor and the attractiveness of the area as an industrial site were also drawing cards, says Frank Thomas, a Sea Grant seafood extension specialist with NCSU's Food Science Department. Thomas worked with Kibun and city and state officials to help the company locate in Raleigh. Initially,

Photo by Nancy Davis



Masayuki Fukuda

because such a venture was so new to this area, there was concern over the quality of effluent from the proposed plant. But Thomas supplied technical expertise about surimi plants, and city officials approved the facility.

Thomas estimates Kibun's initial investment was about \$4 million. Kibun began its Raleigh operations with one processing line. Now, three lines are in operation, and the company produces 7,000 pounds of its product each day. The company employs 52 workers at its Raleigh site.

Thomas says the Kibun plant operates with state of the art technology. Product quality is closely monitored. Each day, employees take samples, run bacterial analyses, and test the product for its appearance, texture, water content and flavor.

If surimi-based analogs are so popular, will they begin to cut into conventional shellfish markets? Fukuda doesn't think so. "Fresh seafood and blended seafood are completely separate categories. Fresh seafood is wonderful as it is. We have a completely different product to offer," he says. Fukuda adds that he thinks it's important for supermarkets to offer the product as a frozen seafood product rather than alongside fresh seafood.

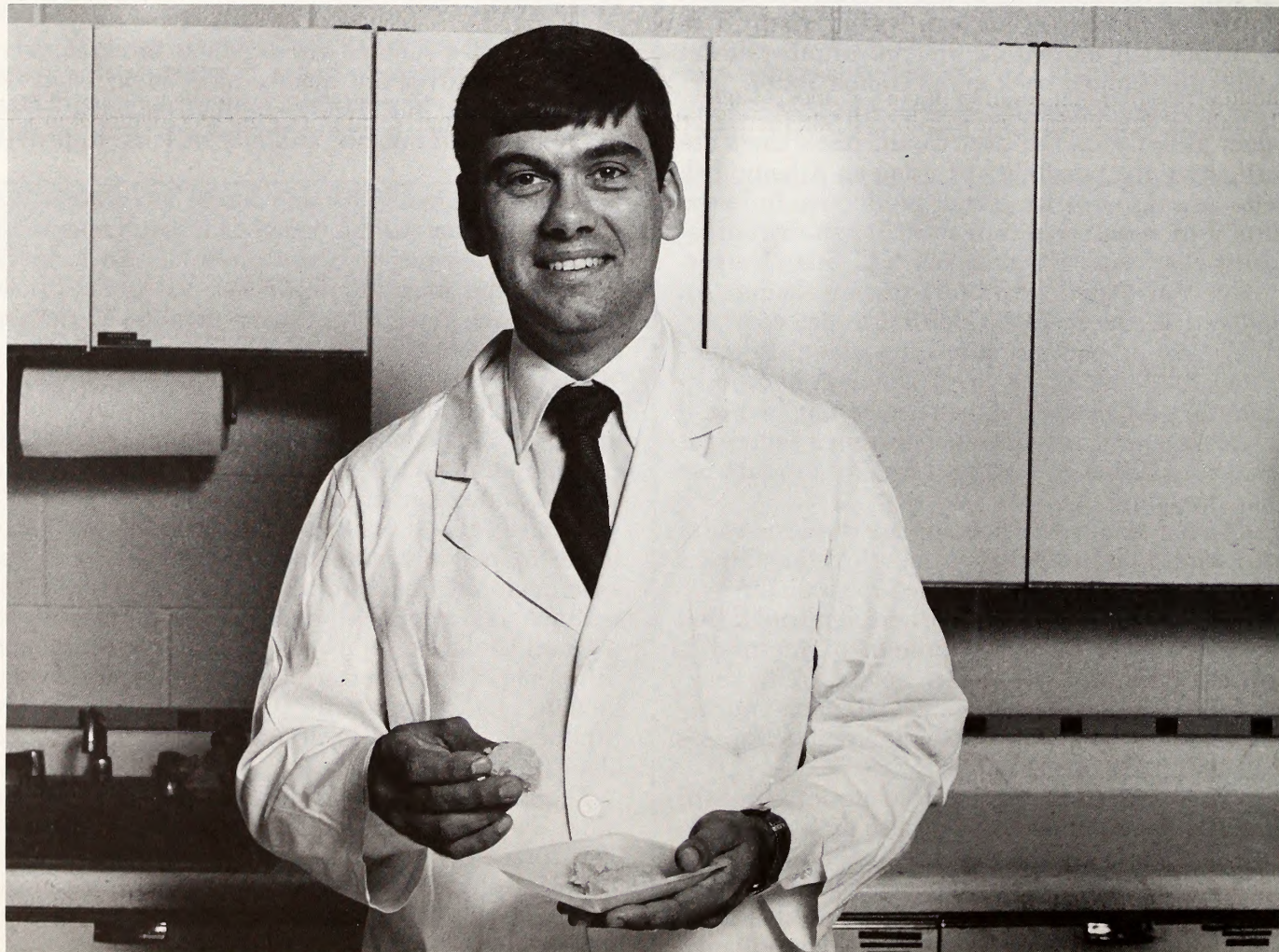
Thomas agrees. "You can't equate one with the other. These seafood products are analogs of shellfish. They're a fully prepared item, a convenience item. We're essentially opening up a new market that probably won't compete with flounder, trout and other fresh seafoods."

SELLING SCIENCE and MENHADEN

*Sea Grant researcher Tyre Lanier is selling
the seafood industry on menhaden surimi*

By Kathy Hart

Photo by Allen Weiss



Tyre Lanier is a scientist by trade, but a salesman at heart. He delivers a spiel that is fast, slick and convincing. He glibly describes how the lowly menhaden, a fish once used for fertilizer and animal feed, can be transformed into nutritious food additives. When he's finished, you're as sure as he is the menhaden is destined for the dining room.

But Lanier is not a double-talking huckster. His "soft sell" of menhaden is straightforward and honest. It's based on hard facts, good science and an earnest belief that menhaden derivatives can mean as much to the food industry as the soybean.

In fact, Lanier, a Sea Grant researcher and food scientist, introduces the menhaden as "the soybean of the sea"—a Madison Avenue marketing phrase he coined to sell menhaden companies and seafood processors on the fish's versatility and potential.

Food processors know the story of the soybean. But for those who don't, Lanier describes how years ago Henry Ford (of automobile fame) saw the contribution the soybean was making to nutrition in the Far East. Ford initiated research that resulted in edible oils and protein concentrates which today can be found in almost every manufactured food product in America. Lanier envisions a similar fate for the menhaden.

"The way the soybean evolved into the food industry is almost identical to the way we think the menhaden will evolve," Lanier says. "We want the food industry to see that analogy. We want them to see that something they now perceive as (animal) feed or worse can easily become a food ingredient. Soybeans permeate so many food products beyond where you would normally expect them to be. In other words, the first person to perceive putting soybeans in food would have probably said, 'Let's put it where the seed grains go or the legumes go.' They wouldn't have thought about putting them in bacon bits or milkshakes, strange places like that."

To follow the path of the soybean would elevate the menhaden from its present status as an industrial fish. Like the soybean at the turn of the century, menhaden oil is not approved for domestic food use, and the protein is used almost entirely for animal feed.

Such a lowly fate has lowered the

menhaden's value (5 cents per pound) as compared to other fish, although the fishery remains the nation's largest in terms of volume. In Lanier's eyes, it's the menhaden's low price and high volume that make it a likely candidate for the "soybean of the sea."

Now that Lanier has you convinced of the menhaden's potential, he's ready for the hard sell—menhaden surimi. He begins surprisingly by saying that today all surimi is made from the Alaska pollock, a white-fleshed fish that is low priced and abundant.

BUT, he emphasizes, rumblings from Alaskan fishery managers indicate that pollock stocks may not be as limitless as once believed. With a second punch, he raises the doubt that any one fishery can meet the growing demand for surimi. "If surimi expanded to food chains such as McDonald's or Hardee's," Lanier says, "the pollock fishery could not meet the demand for such large volumes."

Finally, he adds that food processors have perfected a method for filleting the pollock, making it a potential product for higher priced traditional seafood markets.

After casting a shadow on the pollock, Lanier opens the door for an alternative—the menhaden. For four years, Lanier and food scientist Frank Thomas have been working on various Sea Grant projects at NCSU to perfect the making of surimi from menhaden. They know that only science can transform the menhaden from a possibility into a reality. And rest assured, Lanier knows his science as well as his salesmanship.

Pausing from his sales pitch, Lanier admits that menhaden presented some unique problems. It contains a significant amount of dark muscle that could discolor the surimi product. The fish, especially the Gulf species, had a high fat content that could adversely affect the gelling quality, flavor, storage stability and fat content of the surimi. And the processing procedure required large volumes of water and produced large amounts of effluent.

Later the research team identified another problem: an enzyme present in the meat that could cause textural problems if heated to certain temperatures. But, Lanier stresses that this only poses a problem if the surimi is processed into traditional meat "sausage" products such as hot dogs, bologna or luncheon meats. It presents no road-

blocks for manufacturing pseudoshellfish products—menhaden surimi's most likely avenue of entrance into food processing.

Back to his peddling, Lanier smoothly counters each problem with scientific research. He reports that the light and dark muscle tissues have been successfully separated under laboratory conditions. If very fresh fish is used, the two meats can be separated in the straining step of the surimi process. And more rigorous washing has reduced the fat content to less than 1 percent in surimi made from Atlantic menhaden and less than 3 percent from Gulf menhaden.

Next, Lanier called in another Sea Grant researcher, NCSU civil engineer Allen Chao. Chao developed a method to reduce water needs and concentrate the effluent. The concentrated effluent can be funneled into existing menhaden reduction plants and recovered for feed or fertilizer.

The scientists are currently tackling the enzyme problem, Lanier says. They are looking for an additive that might inhibit the enzyme or a process that would remove it altogether. Even without a solution at hand, Lanier confidently says menhaden can be refined into "a surimi of a quality comparable in many ways to that prepared from Alaska pollock."

With many research results in hand and more on the way, Lanier is ready to accept his commission—application of the research on a commercial scale. In fact, Lanier probably developed his peddling pitch because of efforts to interest a menhaden industry bent on animal feed in food products.

But interest he did. To get started in this new line of production, the menhaden industry asked the federal government for some assistance. This year, the National Marine Fisheries Service awarded Zapata Haynie Corporation a fisheries development grant to build a pilot menhaden surimi plant in Reidsville, Va.

When the plant becomes operational this summer, a university advisory panel, including Lanier, will examine the quality of the plant's surimi production—the surimi's fat content, protein content and gelling ability.

What becomes of Sea Grant's top salesman after he collects his commission? He continues to upgrade his product and look for other ways to refine the menhaden into edible products.

Serving Up Seafood Substitutes

Face it. When it comes to flavor, it's hard to beat the taste of fresh crabs, scallops, shrimp and lobster. But those catches aren't always available. And, even when they are, the price may turn more than one cook's head toward a surimi-based substitute.

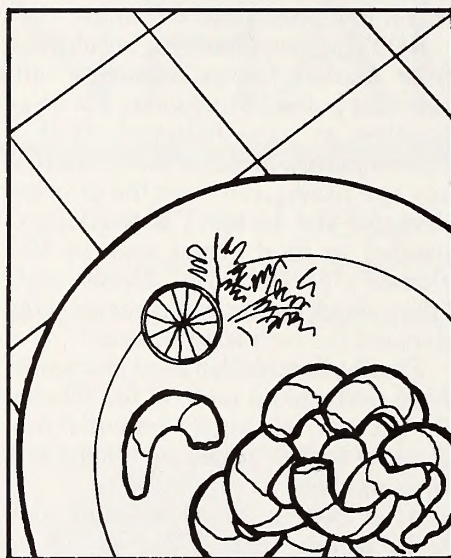
We're not advocating you give up on the real thing, because nothing could take its place. But the surimi-based substitutes have some positive points you should consider. For example, food scientists say the imitations often are more nutritious, containing higher protein and lower fat, calories and cholesterol than the natural counterparts. Some food scientists say surimi-based products will revolutionize the food industry, predicting such edibles as lunch meats, cheeses, snack chips and even a surimi milkshake. But for the moment, surimi's proven worth is in the shellfish analog business.

Joyce Taylor, Sea Grant's seafood education specialist, says the analogs can be substituted in most recipes calling for the real thing. The analogs are best, she says, when used with sauces or in recipes for dishes such as seafood salads, soups, casseroles or Newburgs.

Below are some suggestions for making the imitations taste less like imitations.

CREAM OF CRAB OR SHRIMP SOUP

2 tablespoons butter or margarine
1 small onion, minced
½ cup minced celery
1 tablespoon plain flour
½ teaspoon salt
½ teaspoon paprika
dash white pepper
1 teaspoon Worcestershire sauce
¾ pound crab or shrimp analog, finely chopped
2 cups milk
2 cups light cream
2 tablespoons sherry
1 tablespoon minced parsley



Melt butter in double boiler. Stir in onion and celery and cook until tender, about 5 minutes. Blend in flour, salt, paprika, pepper and Worcestershire. Add crab or shrimp, milk and cream. Cook over boiling water, stirring constantly until slightly thickened. Stir in sherry just before serving and garnish with parsley. Serves 6 to 8.

CRAB IMPERIAL

¼ cup low calorie mayonnaise
1 egg
½ teaspoon dry mustard
½ teaspoon salt
dash freshly ground black pepper
hot pepper sauce to taste
½ tablespoon minced green pepper
½ tablespoon minced red onion
1 pound crab meat analog, flaked

Combine mayonnaise, egg, mustard, salt, pepper and pepper sauce. Add green pepper and onion. Gently stir in crab meat. Place in individual baking shells and bake at 350 degrees for 15 minutes. Serves 4 to 6.

SHRIMP CASSEROLE

2 tablespoons butter or margarine
½ cup sliced fresh mushrooms
1 tablespoon chopped green peppers
2 tablespoons chopped onion
1 can cream of mushroom soup
½ cup grated mild cheddar cheese
¼ teaspoon freshly ground black pepper
1 pound shrimp analog
¼ cup dry bread crumbs mixed with 1 tablespoon melted butter or margarine

Melt 2 tablespoons butter or margarine. Cook mushrooms, green pepper and onion until tender. Stir in soup, cheese and pepper. Heat, stirring constantly until cheese melts. Stir in shrimp. Pour into greased casserole. Spread bread crumb mixture over top. Bake in a 400-degree oven for 10 minutes or until heated and crumbs are brown. Serves 6.

SEA ENTREE SWISS-STYLE

¼ cup (4 tablespoons) butter, melted
1 tablespoon lemon juice
2 cloves garlic, pressed
½ teaspoon tarragon, crushed
2 tablespoons Parmesan cheese, grated
1 package (8 ounces) lobster tail analog, thawed
salt
pepper
½ cup Swiss cheese, grated

Blend together butter, lemon juice, garlic, tarragon and Parmesan cheese. Place analogs face down on foil-lined cookie sheet or broiler pan. Season with salt and pepper. Brush with half the butter mixture. Broil 5 minutes. Turn analogs over. Brush with remaining butter mixture and sprinkle with Swiss cheese. Broil 1 to 2 minutes. Serve with wild rice. Makes 4 lobster tails.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



This summer, 15 science teachers from North Carolina will see the state from a new perspective. August 10 to 17, they'll join 15 Puerto Rican teachers for the "Sea to the Mountains Environmental Education Workshop," organized by Lundie Spence and Juan Gonzalez, marine education specialists from the North Carolina and Puerto Rico Sea Grant programs respectively. Any North Carolina science teacher with a pair of tennis shoes, a sense of adventure and a love of nature is eligible.

In one week, the teachers will travel from the coast to the mountains, exploring the temperate ecosystems of North Carolina and learning teaching techniques for marine science classes. They'll trek down a nature trail at Greenfield Lake, examine salt marshes and ocean ecology, relive history with the Cherokees and raft down the Nantahala River. In addition, education materials and field guides will be identified and activities from national science curricula will be used.

The week will also give the North Carolina teachers the opportunity to compare the state's ecosystems with the tropical ones of Puerto Rico and to share ideas from different cultures.

The workshop is sponsored by UNC Sea Grant, Puerto Rico Sea Grant, the N.C. Math/Science centers at the University of North Carolina at Wilmington and Western Carolina University, the N.C. Marine Resources Center at Fort Fisher, Discovery Place, the Highlands Biological Station and the N.C. Wildlife Resources Commission.

Cost for the workshop is \$175. This includes housing, some meals and transportation costs. Deadline for registration is April 1. For more information, write Spence at UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605. Or call, 919/737-2454.

Sea Grant has a new seafood extension specialist at the NCSU Seafood Laboratory in Morehead City. David Green, a Ph.D. candidate in food science at NCSU, will work with North Carolina seafood handlers and processors.

While at NCSU, Green worked with Sea Grant researchers Tyre Lanier and Allen Chao on menhaden surimi processing and on wastewater reduction in surimi operations.

At the seafood lab, Green will introduce clients to new technology, emphasize fundamental seafood handling and processing sanitation practices, and recommend measures to reduce water consumption and waste generation during processing. Green will continue the lab's work on the smoking of mid-Atlantic seafoods.

If you have questions about seafood processing, contact Green at the lab at 919/726-7341.



If you're hooked on fresh North Carolina seafood, you'll want a copy of a brochure compiled by Joyce Taylor, Sea Grant's seafood education specialist. *Hooked on Fresh Fish and Shellfish* gives consumers tips for choosing seafood at the market.

You should know, for example, that a fresh fish will have bright, clear and protruding eyes. If its eyes are cloudy, pink and sunken, there's a good chance that fish has been out of the water too long. If a fish doesn't look fresh, it won't taste fresh either, says Taylor.

Hooked on Fresh Fish and Shellfish will provide you with tips for buying fresh fish, shrimp, clams, scallops, oysters, crabs and lobsters. Taylor explains the difference between the var-

ious market forms of fish, and she takes the guessing out of deciding how much to buy. A chart provides consumers with serving suggestions.

For a copy of the free brochure, write Sea Grant. Ask for UNC-SG-85-08.



Both fishermen and fishery managers would like to know the secret for the biggest catches and the most profits. With the help of three N.C. State University economists, the answer can be revealed.

Robert Kellogg, J.E. Easley Jr. and Thomas Johnson recently developed a bioeconomic model and optimal control theory and applied it to the North Carolina bay scallop fishery. For their study, biologic and economic data were fed into a computer model. By altering these economic and biologic variables, the effects of management decisions on the economic returns of the state's bay scallop fishery were examined. Their results are published in *A Bioeconomic Model for Determining the Optimal Timing of Harvest for the North Carolina Bay Scallop Fishery*, which is available from UNC Sea Grant. The information included in this publication should be a useful guide for development of management models for other fisheries.

If you would like a copy, send \$2.75 to UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605. Ask for publication number UNC-SG-85-25.

Seafood is the new kid on the block when it comes to restaurants and grocery stores. Consequently many seafood buyers don't know as much about fish and shellfish as they do about pork, beef and chicken.

To help those new to purchasing seafood, Sea Grant's seafood marketing specialist Gary Van Housen has written a booklet, *A Guide to Purchasing and Handling North Carolina Sea-*

Continued on next page

food for Restaurant Operators and Retailers.

The booklet will help those who buy bulk quantities of seafood determine freshness, check net weights and handle their purchases more carefully. Van Housen also provides descriptions of some of North Carolina's best seafood selections: bluefish, king mackerel, mullet, red snapper, shrimp, blue crabs and more.

For a copy of this publication, write Sea Grant. Ask for publication UNC-SG-86-01. The cost is \$1.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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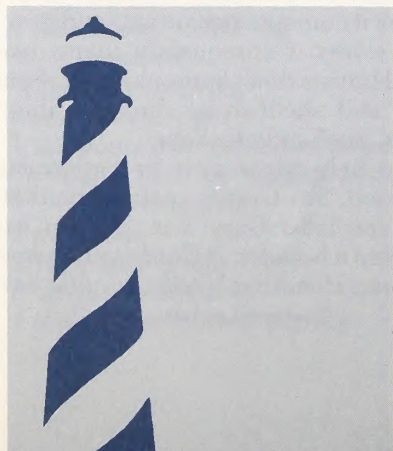
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COASTWATCH



TRAVELING THE COAST

Before you pack the kids, dog and 20 pieces of luggage into your car, consider how you want to spend your beach vacation.

If you want more to show for your time off than a peeling nose, visit some of North Carolina's coastal attractions—state and national parks, aquariums, historic sites, museums or festive events. Focus your binoculars on the white ibises at Pea Island National Wildlife Refuge. Touch a hermit crab at the N.C. Marine Resources Center at Pine Knoll

Shores. Wander through 18th-century homes in Edenton. Or join the hoopla surrounding the Shrimp Festival at Sneads Ferry.

Vacationing along the sandy shores doesn't have to cost a bundle. This month, Coastwatch offers a guide to inexpensive coastal attractions and events, many of them state or federally operated.

OUTDOORS

By Sarah Friday

Get out your beach towel, dust off your binoculars and put on some tennis shoes—North Carolina's coast is waiting. Whether you're a landlubber or a seafarer, take a detour this summer from the motels, putt-putt courses and arcades to see some of the state's natural scenery.

Heron, terns and ducks fly to the Pea Island Wildlife Refuge. Fish swim to warmer waters near Ocracoke. And deer and black bear roam through the woods near the Alligator River. Never mind the mosquitoes; pack your lunch and join them in North Carolina's great outdoors.

■ **Beaches.** Three hundred twenty miles of shoreline stretch along North Carolina's coast. White, sandy beaches lie like a string of pearls between Currituck and Calabash. Find one of these jewels; and soak up some sun, fly a kite, feel the sand between your toes or chase a crab. Night or day, anytime of the year, North Carolina's beaches offer a treasure trove of activities to discover.

■ **State Parks.** You don't have to wait until the Fourth of July to enjoy one of the state parks in eastern North Carolina. Overseen by the N.C. Division of Parks and Recreation, each park offers visitors acres of turf and surf to explore. Camping, picnicking, swimming, hiking and fishing are available at most sites.

Be careful when you smell the flowers at the *Carolina Beach State Park*. Venus' flytrap is one of 30 varieties of plants, trees and flowers along a self-guided park nature trail. 919/458-8206. *Fort Macon State Historic Park and Recreation Area* in Atlantic Beach houses a 150-year-old restored fort used during the Civil War and World War II. 919/726-3775. Allow the beaches and live oaks draped with Spanish moss to charm you at *Goose Creek State Park* near Washington. 919/923-2191.

Photo by J. Foster Scott



Raccoons are common in North Carolina's state and national parks

Unspoiled beaches and nature areas highlight *Hammock's Beach State Park* on Bear Island, near Swansboro. 919/326-4881. Hike up or hang glide over the East Coast's highest sand dune at *Jockey's Ridge* in Nags Head. 919/441-7132.

Canoe through a different ecosystem at *Merchant's Millpond State Park*, a southern swamp forest near Gatesville. 919/357-1191. The 16,600 acres of fresh air may lure you to *Pettigrew State Park* near Creswell. If that doesn't do it, the park's reputation as an angler's paradise may. 919/797-4475. Whether you're looking through a camera lens or a pair of binoculars, you'll see the coast's natural beauty at the *Theodore Roosevelt Natural Area* at Atlantic Beach. Donated by the Roosevelt family, this park offers visitors a unique look at a brackish marsh and maritime forest. 919/726-3775. Park hours: April, May and September—8 a.m. to 8 p.m. June, July and August—8 a.m. to 9 p.m.

■ **Croatan National Forest**, Jones, Carteret and Pamlico counties. Take a hike at the Croatan National Forest. Thousands of acres of forestland and seven recreation areas offer visitors miles of shaded woods to explore. In addition, boating, fishing, camping and swimming facilities are available. 919/638-5628.

■ **Cape Lookout National Seashore.** Let Mother Nature amaze you with her beauty at the Cape Lookout National Seashore. Fifty-five miles along the Outer Banks, from Ocracoke Inlet to Beaufort Inlet, were reserved by the National Park Service in 1966 to preserve an area rich in natural and recreational resources. The three islands in the seashore—Shackleford Banks, Core Banks and Portsmouth Island—can only be reached by boat or ferry. The trip is worth it, however, for the chance to swim or fish off quiet beaches, collect conchs or watch

Photo by Gene Furr

a mother sea turtle struggle to shore to lay her eggs. Make these discoveries on your own, or join one of the ranger-led programs available June 15 through Labor Day. 919/728-2121.

■ **Cape Hatteras National Seashore**, Dare and Hyde counties. Picture yourself in a landscape at the beach. The sky is painted dark rose and orange as the sun sets behind you. A flock of gulls pass overhead, and the ocean glimmers. Now turn up the volume. Feel the wind; then smell the salty air.

From Bodie Island to Ocracoke Island, scenes like this occur almost every day. The Cape Hatteras National Seashore stretches more than 70 miles along the Outer Banks, offering nature, history and adventure to its visitors. A variety of fishing spots, from the surf to offshore waters, keep fishermen angling for fish like striped bass and bluefish.

Surf casting and charter boat trips are popular pastimes at Ocracoke, too. If you'd rather stay on the island, go bird watching or view the wild "Banker Ponies," said to have been on the island since the 1500s.

The seashore calendar fills quickly in the summer with organized programs at the six visitor centers. Take a morning bird walk, hear a whale of a tale or find out what's cooking in Ocracoke. National Park Service headquarters, 919/473-2111. Visitor Centers: Whalebone Junction, 919/441-6644; Fort Raleigh, 919/473-5772; Wright Brothers, 919/441-7430; Bodie Island, 919/441-5711; Hatteras Island, 919/995-5209; and Ocracoke Island, 919/928-4531.

■ **National Wildlife refuges.** You could go wild traipsing through any of the seven refuges at North Carolina's coast. The U.S. Fish and Wildlife Service established these reserves as natural habitats for certain species of animals; however, each offers human visitors rich opportunities for observing the wildlife.

Alligator River complex:

Alligator River National Wildlife Refuge, Dare and Tyrrell counties. A relatively new and undeveloped refuge, this 120,000-acre reserve is "wide open," says assistant manager Al Schriver. Its coastal and swamp habitats are unique to this part of the country, attracting many varieties of waterbirds and animals such as deer and black bear. To see the refuge, U.S. 264 is the easiest access, says Schriver. Old logging roads exist for the adventurous.

Pea Island National Wildlife Refuge, Dare County. Some people might say Pea Island is for the birds. More than 260 species have been spotted in the 5,915-acre refuge that extends along the Outer Banks from Oregon Inlet to the village of Rodanthe. With a pair of binoculars and a little luck, visitors may spot a brown pelican skimming by or a fox or a pheasant hiding in the brush. Although bird watching is a



favorite activity in the refuge, nature study programs, photography, hiking, surf fishing, swimming, sunbathing, surfing and crabbing are equally popular.

For those who really want to rough it, the *Currituck Wildlife Refuge* in Currituck County waits. Shorebirds and wildlife are similar to the kinds found at Pea Island, but brushland is more plentiful here, providing habitat for smaller creatures. The refuge and beaches are open to the public; however, there are no facilities or developed roads.

For information on any of the refuges in the Alligator River complex, call 919/473-1131.

Mattamuskeet complex:

Mattamuskeet National Wildlife Refuge, Hyde County. In the winter, things get kind of crowded at Lake Mattamuskeet. It gets awfully tough for a tundra swan or a Canada goose to find a parking place with thousands of

*North Carolina
beaches offer endless
hours of summer fun*

Continued on next page



Hang glide over sandy dunes at Jockey's Ridge State Park in Nags Head

other waterfowl vying for a space. The birds are still plentiful in the summer and fall, but not in as great a number. What most folks hope to find that time of year are the fish—largemouth bass, catfish and bream. 919/926-4021.

Cedar Island National Wildlife Refuge in Carteret County and the *Pungo National Wildlife Refuge* in Washington and Hyde counties are two other favorite stopping-over places for waterfowl. The swampland and woodland lure birds, fish, reptiles and amphibians, as well as outdoor enthusiasts. Educational programs and tours are available. Cedar Island Refuge: 919/225-2511.

For a lesson in ecosystems, visit the *Pungo National Wildlife Refuge*. This 12,229-acre refuge, a mixture of farmland, brushland, forest and freshwater marsh, serves as a wintering habitat for migratory birds and shelter for a diverse collection of wildlife and many endangered species. Visitors may see raccoons, bobcats, egrets, ibises or a bald eagle. It only takes a visit. 919/926-4021.

Daniel Boone would probably have been impressed by the *Swanquarter National Wildlife Refuge* in Hyde County. Described as a "true wilderness," the refuge provides estua-

rine marsh habitat for waterfowl and mammals such as white-tailed deer, raccoons, otters and mink. 919/926-6751.

Mackey Island National Wildlife Refuge, Knott's Island, Currituck County. Located partially in Virginia and partially in North Carolina, this remote refuge can only be reached through Virginia or by a ferry from Currituck. Hiking, bird watching and deer hunting in the fall are only a few reasons the public likes the reserve as much as the wildlife.

After deciding what to see on vacation, decide how to see it. Many of the historic coastal towns offer walking tours, and the N.C. Department of Transportation Bicycle Program has maps of several coastal routes that range from 23 to 43 miles. 919/733-2804.

Sailing, boating, fishing, canoeing, rafting and camping information can be found in the *North Carolina Camping and Outdoors Directory* available from the N.C. Division of Travel and Tourism (1-800-VISIT NC). In addition, Sea Grant recently published the *1986 North Carolina Saltwater Sportfishing Tournament Guide* for competitive anglers. For a copy, write Sea Grant and ask for UNC-SG-86-04.

MUSEUMS & MORE

By Kathy Hart

Going to museums and aquariums isn't what it used to be. No more dark, dank rooms, boring displays and lifeless exhibits. Public facilities like the N.C. Marine Resources Centers and the N.C. Maritime Museum have come to life—marine and coastal life that is.

Museums, aquariums and galleries in coastal North Carolina are putting their best exhibits and programs forward as they tell us more about the ecology, history and art of the region.

The North Carolina Marine Resources Centers (soon changing their name to the N.C. Aquariums), Roanoke Island, Pine Knoll Shores and Fort Fisher. Entering the doors of one of North Carolina's three marine resources centers may mean taking a chance . . . on meeting a black-tip shark face-to-face, touching the prickly spines of a sea urchin or seeing one of the ocean's masters of disguise, the flounder. But it's a chance that can be exciting and educational, too.

Living up to their new name, the centers have tank after tank of marine creatures—sea turtles, eels, lobsters, stingrays, crabs, starfish, sharks and other fish native to the North Carolina coast. But the centers also offer more: exhibits, programs, films and field trips on coastal ecology, history and art.

With the guidance of center personnel, you can spend the day on a trawler learning about commercial fishing or explore the abundant and varied life in a salt marsh. Many of the field trips are free. Pre-registration is often required. For a calendar of summer events and registration dates, write the centers.

And don't think if you've seen one of the facilities you've seen them all. Each focuses on a different aspect of the coast.

The Roanoke Island center emphasizes the unique ecology of northeastern North Carolina by focusing on the Pamlico and Albemarle

Photo by Mark Joyner



Photo by Steve Murray



sounds and the Alligator River. Along with saltwater aquariums, this facility also has a freshwater tank for native creatures that take less salt in their water. And visitors can see a newly mounted nine-foot alligator.

To learn how creatures survive in the sea through adaptation, visit the Pine Knoll Shores center. There, an aquarium exhibit will show how sea creatures use speed, venom, camouflage, mimicry, electricity, armor, bioluminescence and more to survive. For an enlarged view of North Carolina's sea life, the center features a newly constructed wall of porthole-size aquariums equipped with magnifying glasses.

At Fort Fisher, the emphasis is on large sea life. That facility houses the largest free-standing aquarium in the state, and in its 20,000-gallon tank swim several species of native sharks and their relatives, skates and

At one of the Marine Resources Centers, an octopus (above) poses for a picture and a student (below) gets firsthand experience with a crab

Continued on next page



A view inside the N.C. Maritime Museum in Beaufort

stingrays. For a glimpse of a gentler breed, see the 49-foot replica of a living humpback whale named Salt.

Last year the centers attracted over 1 million visitors. This year, they hope to educate even more people about North Carolina's marine resources as they celebrate their 10th anniversary in September. The centers are open year-round Monday through Friday from 9 a.m. to 5 p.m. and Saturday and Sunday from 1 to 5 p.m. Admission is free.

For more information, contact the Roanoke Island center at P.O. Box 967, Manteo, N.C. 27954 (919/473-3493); the Pine Knoll Shores center at P.O. Box 580, Atlantic Beach, N.C. 28512 (919/247-4003); the Fort Fisher center at Box 130, Kure Beach, N.C. 28449 (919/458-8257); or the Office of Marine Affairs, 417 N. Blount St., Raleigh, N.C. 27601 (919/733-2290).

The North Carolina Maritime Museum, Beaufort. The N.C. Maritime Museum has opened the hatches on a new home. Last year the museum gathered up its collections and moved to a larger building. Outside, the wooden building blends 19th-century Beaufort architecture with that of the early U.S. Lifesaving Service stations. It even features a widow's walk, or observation platform, that provides a panoramic view of the area.

Inside, you enter a pseudo ship's hold as you view exhibits of coastal bird, fish and mammal

specimens; marine fossils; worldwide and North Carolina shell collections; maritime artifacts; saltwater aquariums; decoys and indigenous small craft.

Across Turner Street at the Watercraft Center, museum staff teach the art of building small wooden boats. Visitors can tour the center and watch the craftsmen.

The museum also sponsors many programs, field trips and special events. During the summer, youngsters in grades 1 to 8 can attend a week-long summer science school that moves the classroom outdoors. Or for folks of all ages, the museum offers the Spring Gathering of Small Wooden Boats (June 7 to 8) and the Strange Seafood Exhibition (August 21).

For more information about the museum and its programs and events, write the N.C. Maritime Museum, 315 Front Street, Beaufort, N.C. 28516. Or call 919/728-7317. Admission is free. The hours are 9 a.m. to 5 p.m. weekdays, 10 a.m. to 5 p.m. Saturday and 2 to 5 p.m. Sunday.

Aurora Fossil Museum, Aurora. For a look back at the coastal plain's geologic history, visit the Aurora Fossil Museum. View the museum's main fossil exhibit, and see the backbones of prehistoric whales, the teeth of a 55-foot great white shark and a collection of ancient sea-shells. Huge wall murals depict creatures that lived in the ocean that covered eastern North Carolina 5 to 15 million years ago.

The museum is presently undergoing renovation. It should reopen in June. For a schedule of its hours, write P.O. Box 48, Aurora, N.C. 27806.

New Hanover County Museum, Wilmington. The Cape Fear region is rich in history—history that is brought to life through the exhibits of the New Hanover County Museum, located at 814 Market Street in Wilmington. You'll see Confederate artifacts, items brought to Wilmington aboard blockade runners, Indian dugout canoes and a diorama of the Wilmington waterfront during the Civil War. Or attend one of the museum's weekly programs or special classes.

Admission is free, and museum hours are 9 a.m. to 5 p.m. Tuesday through Saturday and 2 to 5 p.m. Sunday. For more information, call 919/763-0852.

St. John's Art Gallery, Wilmington. For an education in art, stop by St. John's Art Gallery, located at 114 Orange Street in Wilmington. Outside, study the design of the gallery's 19th-century architecture. The building was built in 1802 as the home of St. John's Lodge No. 1, the oldest masonic lodge in North Carolina.

Inside, see the preserved mural of masonic symbols and any of the changing exhibitions of North Carolina and southern art. In addition,

NORTH CAROLINA LIGHTHOUSES

Standing as sentinels on the sand, the North Carolina lighthouses have warned many oceangoing vessels of the treacherous shoals offshore. Although they no longer use reflective lenses to broadcast their light, many of the lighthouses are still in operation using automated beams. Only two have darkened their lights and been abandoned. All are worth a visit, if only as a reminder of another day in ocean navigation.

The red brick **Currituck Beach Lighthouse** stands 158 feet tall near the village of Corolla. The **Bodie Island Lighthouse**, marked by broad alternate black and white bands, stands north of Oregon Inlet. The old lightkeeper's house has been converted into a visitor center and natural history museum by the Cape Hatteras National Seashore. Living history presentations recount the history of the lighthouse, shipwrecks and life-saving along the Outer Banks.

The **Cape Hatteras Lighthouse**, noted for its black and white candy-striped pattern and height (rising 225 feet above sea level—the tallest in America), stands threatened by the very sea against which it warns. Located in Buxton, the lightkeeper's house has also been converted into a visitor attraction, the Museum of the Sea.

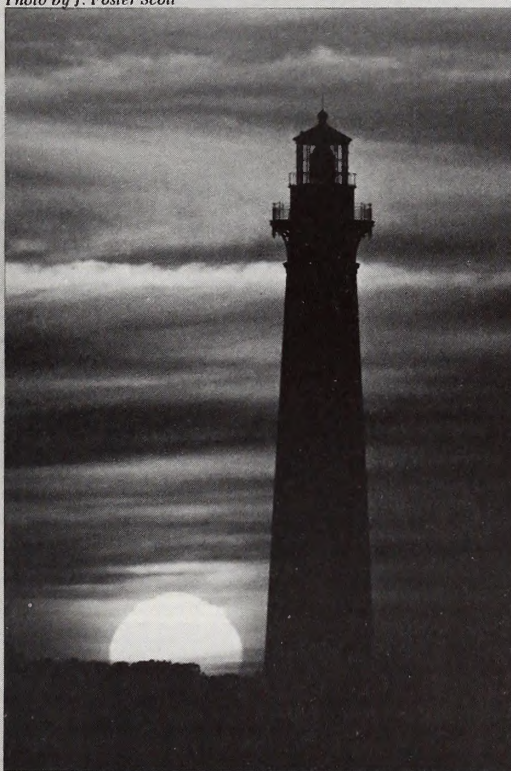
The white, 76-foot **Ocracoke Lighthouse**, the second oldest operating lighthouse in the United States, overlooks the fishing village of the same name. To its south, the **Cape Lookout Lighthouse**, remembered for its diamond pattern, is also threatened by an encroaching sea. Located on Core Banks, the lighthouse is accessible only by boat.

Price's Creek Lighthouse, located about two miles above Southport, guided vessels up the Cape Fear River to Wilmington. Abandoned, the lighthouse today stands in

disrepair on private property, and permission is needed to visit it. Also inoperative is the 90-foot **Bald Head Lighthouse** located on Smith Island, a private resort island. Flashing the brightest beam in the United States, the **Oak Island Lighthouse** rises 169 feet above sea level and sports a three-toned exterior of black, gray and white.

If you're planning to visit the lighthouses, keep in mind that, with the exception of the Bald Head Lighthouse, these coastal sentinels can only be viewed from outside. Visitors can enter the Bald Head Lighthouse and climb its wooden stairs to the top.

Photo by J. Foster Scott



the museum sponsors lectures, concerts, special programs and classes.

The museum is open 10 a.m. to 5 p.m. Tuesday through Saturday. Admission is free. For more information, call 919/763-0281.

Museum of the Albemarle, Elizabeth City. Take a focused look at the history, geography and sociology of northeastern North Carolina by visiting the Museum of the Albemarle.

Inside you'll find exhibits that show and tell about Indian artifacts, the area's geography, the history of the U.S. Coast Guard, old fire engines, old shipyard equipment, nautical items and more.

The museum is located on U.S. 17 South. Its hours are 9 a.m. to 5 p.m. Tuesday through Saturday and 2 to 5 p.m. Sunday. Admission is free.

HISTORIC SITES

By Nancy Davis

Photo by Gene Furr



Reenacting the past at Fort Macon (above); the Elizabeth II, the centerpiece of America's 400th Anniversary celebration, moored in Manteo harbor (right)

Photo by Clay Nolen



Welcome to Sea Grant's tour of historic North Carolina. For the next several pages, we'll be taking a journey back in time—back to the days when the first settlers were charting the course for North Carolina. We'll begin our adventure in the northern part of the state and work our way south. Please hang on because we'll be traveling back several hundred years in time and making quite a few stops. Have a pleasant journey.

■ **Historic Albemarle Tour**, Albemarle Sound region. Following the Historic Albemarle Highway Tour is one of the best ways to get an overview of the first years of the state's history. You'll travel coastal highways to the Lost Colony, Elizabethan Gardens, Somerset Place, Belhaven Memorial Museum, Bath, the Hope Plantation, Edenton, Halifax and Murfreesboro. Since our time is limited, we'll only stop at a few of the sites. For information on others, please call 919/482-7325.

■ **Historic Edenton**. In Edenton, the townspeople were defiant even before the Bostonians. In 1774, Edenton women held their own tea party, signing a resolution supporting the acts of the rebellious provincial congress. Today the town is known for its well-preserved homes and buildings spanning 250 years. A complete walking tour is \$3 for adults, \$1.50 for students. 919/482-3663.

■ **Wright Brothers National Memorial**, Kill Devil Hills. On Dec. 17, 1903, Orville and Wilbur Wright placed a winged contraption on level ground. Orville took the pilot's position, and at 10:35 a.m., the machine moved forward under its own power and lifted him into the air. Now, the National Park Service maintains the site of that historic first flight. It includes a visitor center, a monument atop Kill Devil Hill and a reconstruction of the Wrights' 1903 camp. Free admission. 919/441-7430.

■ **Fort Raleigh National Historic Site**, Roanoke Island. Nowhere is the state's colonial history older than here at Fort Raleigh. The 1585 earthen fort has been reconstructed in what experts believe is the original site. A museum and visitor center tell the story of the first English settlers in North America. Free admission. 919/473-5772.

■ **Elizabethan Gardens**, Roanoke Island. These 16th-century gardens are a tribute to the Elizabethan men and women sent by Sir Walter Raleigh to colonize the New World. The formal and informal plantings include an herb, rose and wildflower garden. Admission is \$2 for adults. Group rates are available. 919/473-3234.

■ **Elizabeth II**, Manteo. If you've got your sea legs, we're ready to set sail aboard the *Elizabeth II*. This 69-foot ship is a replica of the Elizabethan vessels used in Sir Walter Raleigh's voyages 400 years ago. Admission is \$3 for adults and \$1.50 for children ages 6 to 12. 919/473-1144.

■ **Historic Bath Town**, Bath. The oldest incorporated town in the state, Bath was once the site of an Indian town. English settlers arrived in this area in 1695 and incorporated the town in 1705. Today you can tour many of the 18th- and 19th-century buildings, including the state's oldest church. Admission is \$1 for adults and 50 cents for children. 919/923-3971.

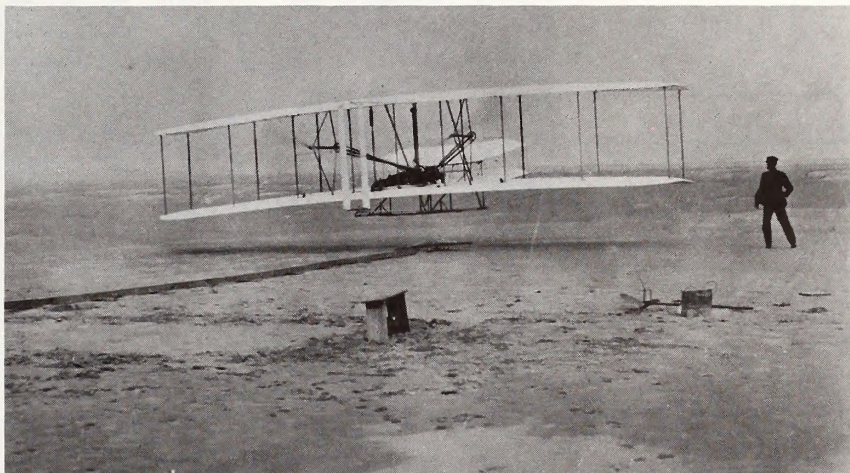
■ **Chicamacomico Lifesaving Station**, Rodanthe. It's fitting that a bit of coastal life is preserved here at the Chicamacomico Lifesaving Station. From 1874 until 1954, lifesaving crews battled the treacherous shoals and surf of Hatteras Island to make daring rescues. Free admission. Call 919/987-2203 for a schedule.

■ **Tryon Palace**, New Bern. In colonial times, this was known as the most beautiful building in America. And even now, the most elaborate modern structures can't match the splendor of the home where both royal and colonial governors lived, met with their legislatures and conducted official business. Admission for a tour of all buildings and gardens is \$9 for adults and \$4 for students. 919/638-1560.

■ While we're stepping back into colonial America, let's take a stroll through the streets of historic **New Bern**. Founded in 1710 by German and Swiss settlers who named it after Bern, Switzerland, New Bern was a thriving seaport and government center in colonial times. 919/637-3111.

■ **Ocracoke**. This remote village exemplifies coastal life before the condo craze. Ocracoke's history harks back to the days of Blackbeard and the Revolutionary War. The village is accessible by ferry from Swan Quarter, Hatteras or Cedar Island.

■ **Portsmouth**. Just across the inlet from



Ocracoke lies Portsmouth Island. This village, included in the National Register of Historic Places, is part of the National Park Service's Cape Lookout National Seashore. Once a flourishing shipping point, Portsmouth is deserted now, but maintained by the park service. You can reach Portsmouth by way of two concessioners who operate ferries from Ocracoke and Cedar Island, or you can take your own boat to the island. 919/728-2121.

■ **Fort Macon**, Bogue Banks. Attention troops. We're about to enter Fort Macon, a restored pre-Civil War fort. It was completed in 1834 to protect the area around Beaufort from sea attack. Now, the fort is part of the N.C. Division of Parks and Recreation. Free admission. 919/726-3775.

■ **Historic Wilmington Tour**. Get your walking shoes ready for a tour of this historic port city. You'll take a seven-block stroll through 18th- and 19th-century Wilmington. Tours are \$5 for adults and \$2.50 for children. 919/762-2611.

■ **USS North Carolina Battleship Memorial**, Wilmington. She's retired now, but her decks are still in service for tourists. In fact, over 231,000 visitors helped make this seafaring lady the state's premier tourist attraction in 1984. Commissioned in 1941, the *USS North Carolina* was the first of the modern American battleships. Stationed just across the Cape Fear River from downtown Wilmington, the 35,000-ton battleship hosts daily tours of her nine decks and levels. Admission is \$3 for visitors over 12 and \$1.50 for children ages 6 to 11. 919/762-1829.

■ **Orton Plantation**, south of Wilmington. It's spring at Orton Plantation, and you're just in time to see the azaleas, camellias, wisteria, dogwood and fruit trees in bloom. This 18th-century plantation features one of America's finest gardens. Admission is \$4.50 for adults and \$2 for children ages 6 to 12. 919/371-6851.

Continued on next page

Wilbur and Orville Wright made this historic first flight at Kitty Hawk on December 17, 1903

FESTIVALS AND EVENTS

Join the celebration. Center your coastal visit around one of the area's many special events. Cities up and down the coast honor local flora such as the azalea, crops and catches such as the peanut and the shrimp, and special events such as the Fourth of July. Here's a sampling of coastal events.

■ APRIL

10 - 13. North Carolina Azalea Festival. Wilmington. 919/762-2613.

■ MAY

9 - 11. 14th Annual Hang Gliding Spectacular. Jockey's Ridge State Park, Nags Head. 919/441-4124.

16 - 18. Pleasure Island Spring Festival. Carolina and Kure beaches. 919/458-8434.

23 - 25. RiverSpree Festival. Elizabeth City. 919/335-4365.

■ JUNE

7. Dare Day. Manteo. 919/473-2143.

7 - 8. Spring Gathering of Small Wooden Boats. N.C. Maritime Museum, Beaufort. 919/728-7317.

13 - August 30. "The Lost Colony." An outdoor drama in Manteo. Beginning in June, presented nightly, except Sunday, at 8:30 p.m. Reservations recommended. Write P.O. Box 40, Manteo, N.C. 27954, or call 919/473-2127.

13 - 14. North Carolina Blue Crab Derby. Morehead City. 919/726-6340.

Mid-June. Great Trent River Raft Race. A homemade raft race on Trent River in New Bern. 919/637-6144.

21. Wanchese Seafood Festival and Blessing of the Fleet. Wanchese. 919/261-3801.

27 - 28. Old Homes Tour and Antique Show. Beaufort. 728-5225.

Late June to mid-August. "Blackbeard: Knight of the Black Flag." An outdoor drama in Bath. 919/792-4977.

■ JULY

4. Belhaven Fourth of July Celebration. 919/943-3370.

4. Fourth of July Fireworks. USS North Carolina Battleship Memorial in Wilmington. 919/762-1829.

4. July 4th Celebration. Waterfront Park, Elizabeth City. 919/338-3860.

4. Optimist Fabulous Fourth. Edenton. 919/482-3400.

4 - 6. Croaker Festival. Oriental. 919/249-0031.

25 - 27. Washington Summer Festival. 919/946-9168.

■ AUGUST

9. Shrimp Festival. Sneads Ferry. 919/327-3388.

21. 10th Annual Strange Seafood Exhibition. N.C. Maritime Museum, Beaufort. 919/728-7317.

■ SEPTEMBER

13 - 14. Currituck Wildlife Festival. Barco. 919/336-2787.

26 - 28. 8th Annual N.C. Waterfowl Weekend. Nags Head. 919/261-3801.

27. National Hunting and Fishing Day Expo. Manteo. 919/473-3493.

■ OCTOBER

3 - 4. Peanut Festival. Edenton. 919/482-3400.

3 - 4. Spot Festival. Hampstead. 919/270-2464.

3 - 5. October Marsh and Sea Fest. Manteo. 919/473-3493.

11. 32nd Annual Mullet Festival. Swansboro. 919/326-4256.

11 - 12. 6th Annual N.C. Oyster Festival. Ocean Isle Beach. 919/754-6644.

Mid-October. Pleasure Island Octoberfest. Carolina and Kure beaches. 919/458-8434.

27 - 28. Festival by the Sea. Holden Beach. 919/842-6844.

Photo by Clay Nolen



Sailing regattas are a part of many coastal celebrations

■ **Brunswick Town**, near Southport. The British burned this town in 1776, and it was never rebuilt. Then, during the Civil War, Fort Anderson was constructed on part of the village site. Today, a nature trail meanders past colonial foundations, the ruins of St. Philips Church and the fort's earthenworks. Admission is free. 919/371-6613.

■ **Fort Fisher**, three miles south of Kure Beach. The last major stronghold of the Confederacy, this fort was the largest earthwork fortification in the South during the Civil War. The fort fell in January 1865, severing the Confederacy's supply line. Located on site are the remains of the fort and a visitor center/museum. Admission is free. 919/458-5538.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



Sportfishing tournaments are nothing new. But how about a tournament that awards purses to the fishermen who land the biggest amberjack, jack crevalle or spadefish? As stocks of popular fish dwindle, tournament officials are likely to include a broader range of fish on their list of target species, says Jim Murray, Sea Grant's Marine Advisory Service director.

To help incorporate underutilized species in tournaments, David Griffith and Jeff Johnson, anthropologists from East Carolina University's Institute for Coastal and Marine Resources, and Murray have written a guide, *Using Nontraditional Fish in Saltwater Sportfishing Tournaments*. The report, published by Sea Grant, is part of a National Marine Fisheries Service study designed to promote underutilized species.

The researchers examine the benefits of adding underutilized species to existing tournaments and of creating a new tournament specifically for them.

To demonstrate the possibilities, the researchers tested their ideas. They worked with officials of a king mackerel tournament to add an amberjack category. And, in cooperation with the South Carolina Sea Grant Consortium, they organized a new tournament for underutilized species in Beaufort County, S.C.

Using Nontraditional Fish in Saltwater Sportfishing Tournaments outlines the researchers' findings and suggestions. For a free copy, write Sea Grant. Ask for UNC-SG-86-05.



For avid saltwater anglers, there's nothing else like them. Fishermen look forward to them, plan their vacations around them and take their whole families to them. What could work an angler into such a fishing frenzy? A saltwater sportfishing tournament, of course.

From late May until early November, it's tournament season. That means anglers flock to the coast for a week or weekend of competitive fishing pleasure. Fishing clubs, marinas and piers sponsor the tournaments in locations all along the North Carolina coast.

This year, Jim Bahen, Sea Grant's marine advisory agent in Wilmington, and his assistant, Gail Miller, called tournament officials from Currituck to Calabash to pin down dates and sponsors. The result is a brochure, "1986 North Carolina Saltwater Sportfishing Tournament Guide," published by Sea Grant. The brochure lists many of the tournaments and the North Carolina saltwater sportfishing records.

For a copy of this free brochure, write Sea Grant. Ask for UNC-SG-86-04.

Sea Grant is offering a marine policy fellowship for graduate study leading to a master's degree in the Department of Sociology, Anthropology and Economics at ECU. The fellowship, which is administered through the ECU Institute for Coastal and Marine Resources, provides a student with a \$6,000 stipend, full tuition and fees (including out-of-state tuition), and funds for supplies, travel and other research expenses. The graduate student will work with Michael Orbach, a maritime anthropologist in the department, on marine policy issues.

Applicants should submit complete transcripts, graduate record examination scores, a statement of interest and at least three references to Orbach at the Institute for Coastal and Marine Resources, ECU, Greenville, N.C. 27834. For more information, call Orbach at 919/757-6883 or 757-6779.

Sea Grant researcher Michael Orbach, a maritime anthropologist at ECU, will offer a course on marine policy at the Duke University Marine Laboratory from July 14 to August 15.

The course introduces students and professionals to marine policy and policymaking. The history of marine organizations, legislation and issues will be traced, and their effects on local, regional, national and international arenas will be explored.

Students in the course may receive credit from either the University of North Carolina at Chapel Hill or Duke University. For more information, write Orbach at the Department of Sociology, Anthropology and Economics, ECU, Greenville, N.C. 27834, or call 919/757-6883. For registration information, call the UNC Institute of Marine Sciences at 919/726-6841 or the Duke University Marine Laboratory at 919/728-2111.



Get beached at summer camp this year! Retreat to Pine Knoll Shores to join the state 4-H program, UNC Sea Grant and the N.C. Marine Resources Center for the "4-H Marine Environment Workshop," July 20 to 25. This unique summer camp will give students ages 14 to 18 the opportunity to examine North Carolina's marine resources and to increase their awareness of ecological problems affecting marine life. Workshop participants also can explore careers in marine-related fields.

Program activities for the week include a marsh habitat study, an ocean beach investigation, snorkeling, a ride on a fishing trawler and field trips. The workshop will be held at the N.C. Marine Resources Center at Pine Knoll Shores, with lodging and other activities at the Mitchell 4-H Camp in Swansboro.

The workshop is limited to 40 participants. Persons who attended previous 4-H marine environment workshops are not eligible, and 4-H membership

Continued on next page

is not a requirement. Interested people should send an application and a one-page letter explaining why they want to attend. Applications and letters must be received by June 15.

The cost is \$125, which includes all field trips, tours, insurance, equipment fees, lodging and meals.

Adult volunteers are needed to assist with the workshop. If you'd like more information, write State 4-H Office, Box 7606, N.C. State University, Raleigh, N.C. 27695-7606. Or call, 919/737-3242.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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___Farming

___State government

___Homemaker

___University professor/researcher

___Lawyer

___Other _____

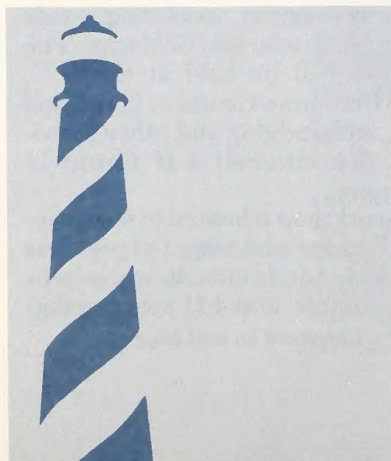
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Photo of Hatteras Yachts Inc. from The News and Observer



CAROLINA CRAFTS

Ask anybody who likes nice boats—the commercial fisherman from Wanchese, the millionaire yachtsman from Greece, the marlin fisherman from Florida. North Carolina boatbuilders make some of the finest boats to meet the water. Such a reputation has helped build a multimillion dollar industry that's shipping revenues right into the pockets of the state's economy.

Boatbuilding has survived in the crossroads and countryside of the coast and thrived in larger towns. On Harkers Island, craftsmen have been famous for years for constructing quality wooden fishing boats. And in New Bern, workers watch fancy fiberglass yachts sail off the assembly line about 80 times a year.

Today, approximately 112 boatbuilders set up shop in

North Carolina, says the U.S. Coast Guard. According to the National Marine Manufacturers Association, North Carolina is the seventh largest boatbuilding state in the country. In dollar terms, that meant more than \$163 million were added to the state's balance sheet in 1984, estimates Jeff Johnson, an anthropologist and Sea Grant researcher at East Carolina University in Greenville. Since then, the figures have only increased.

"North Carolina has rapidly become one of the major boatbuilding manufacturers in the country," says Eddie Smith, owner of Grady White Boats in Greenville and former chairman of the board for the NMMA. Several factors account for the industry's growth and success.

Continued on next page

"We have a great, great labor force of quality people. Also our coastline and surrounding waters just naturally are a big factor." Another asset for boatbuilders is the state's geographic location. It's almost perfect for receiving supplies or sending large vessels by truck or by water.

"And you can't overlook the background—the history of boatbuilding in North Carolina," adds Smith. A hundred years ago, boatbuilders wrought wood into commercial fishing boats at Harkers Island and Wanchese. Many of their descendants still carry on the tradition.

There are other reasons, too, that boating biggies come to North Carolina to build, says Johnson, who recently surveyed 52 companies that manufacture saltwater recreational products in North Carolina. The survey was part of a Sea Grant study with assistant professor Rick Perdue of North Carolina State University.

Labor is one of the biggest enticements, says Johnson. Some firms came to North Carolina because company officials believed the labor force would not unionize. In addition, managements knew initial investments would be high, but in the long run, the move would pay off.

Another lure for boatbuilders is the value of real estate in North Carolina. Companies can buy more property here than, say, southern Florida or New England, and build larger plants. Besides, "It's a nicer place to live," he adds.

North Carolina has been nice to them, too. One company in the study reported a 250 percent increase in business in two years. Bayliner's business went up 60 percent. "It shows this industry is important to the state," says Johnson.

These larger corporate conglomerates bring in about \$40 million in retail sales, says Johnson. But backyard boatwrights and other small operations also make a contribution. "They may make only \$50,000 in net income each year," says Johnson. However, the commercial wooden-boat builders surveyed clearly make a difference, especially in isolated areas where they have a larger impact on the local economy.

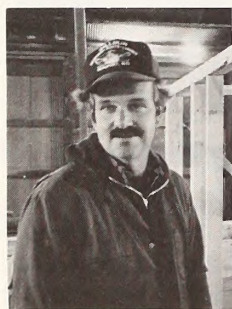
As long as there are fishermen and the national economy stays strong, North Carolina's boatbuilders predict smooth sailing into the future.

— Sarah Friday

Keeping the tradition afloat

Building Wooden Boats

By Sarah Friday



Few things come easier to Jimmy Gillikin of Radio Island than building wooden fishing boats. Like a cook who knows which ingredients to mix for a perfect

dish or an artist who uses the right colors to create a masterpiece, Gillikin "just knows" how to build a boat.

Gillikin is one of a few such craftsmen left in North Carolina. Of more than 100 boatbuilders in the state, about 35 make wooden boats, says Stephen L. Phillips, chief of the Boatbuilding Standards Branch of the U.S. Coast Guard. Demand for the product has dwindled, but some, like Gillikin, have stayed in the business and carried on a prideful tradition made famous in

North Carolina.

Some of Gillikin's talent may be inherited from his father and grandfather. They ran boatwork operations on Harkers Island for more than 40 years during the heyday of boatbuilding. Gillikin was 10 when he first started helping in the boatyard.

Today, Gillikin is owner of Gillikin Craft Inc. He runs a seafood company and builds custom wooden boats part-time. Right now he's working on a 75-foot trawler.

Gillikin starts with an 8-foot piece of plywood and a pencil. No blueprints. He sketches his plans on the board and works from those. He cuts the pine and shapes the boat, trusting his "rack of eye" more than a ruler to get the parts straight. The outside mostly complete, he outfits the inside to suit the buyer's needs.

"Today's boatbuilder is a welder, an electrician, a carpenter and a painter,

but mostly he's a fool," says Gillikin, half jokingly.

Some of the state's boatwrights who work with wood have hit rocky shores in recent years. The increased use of fiberglass and high interest rates forced many out of the industry. But the market for wooden boats remains steady, say most.

"I think it's going to be good," says Harold Varnum, a 35-year veteran boatbuilder from Holden Beach. "We've had these ups and downs before, but never this long." Varnum quit the business in 1981 when interest rates soared to 21 percent, making loans for building out of reach. But he hopes to pick up his hammer and nails again soon.

"There's always going to be somebody who's going to want one," says Gillikin.

Wooden boats are for people who "really know what they want," says



North Carolina wooden fishing boat docked for repairs

Nelson Silva of Ogden, a boatbuilder who uses fiberglass and wood. "It's up to the individual—what they really want."

And understandably, some boaters want fiberglass. The sturdy plastic-like material glided into the market about 20 years ago. Before then, "Everybody wanted fancy wooden boats," remembers Gillikin. "Then they wanted something that would hold up."

Fiberglass boats became particularly popular in the South, where wooden boats tended to mold or rot more quickly because of the heat. There's a larger demand for fiberglass down here, says Silva; so he sells most

of his wooden dinghies and knockabouts up North.

"People assume that fiberglass is going to replace wood altogether, but I don't think it will," says Mike Alford, curator of watercraft research at the N.C. Maritime Museum in Beaufort. "There will always be the need for a custom-built boat, and wood lends itself to that very well. A wooden boat has certain qualities and facts about its nature that are different from other materials, and sometimes that's exactly what you want."

The competition doesn't bother Gary Davis of Marshallberg. A full-time boatbuilder, Davis builds recrea-

tional and commercial boats of any size. Two to three times a year, he sends his latest project sailing down the pike.

Turn-around for wooden boats is slow, says Davis. It takes him about five weeks to build a 19-foot skiff and about six or seven months for a 60-foot headboat. Six days a week he's out in his workshop, making perfect on land what he will send into the water.

Building a large wooden boat is similar to building a watertight house, says Davis. On the outside is the frame and supporting structures that must be fitted, nailed and painted. Under the roof, the boat needs flooring, windows, cabinets, drawers, electricity, electronics and plumbing. Then come the finishing touches.

Davis, like most of the other boatbuilders, sells his boats predominantly in the East, for prices ranging from around \$7,000 to \$150,000. The price tag and individual craftsmanship are two of the biggest selling points for wooden boats. Davis says that if one of his boats is properly maintained, it should last a lifetime.

He learned the craft like most other North Carolina boatbuilders, as a skill handed down through the years like a family treasure. His grandfather Ray from Marshallberg provided Davis with his unique heirloom.

In his grandfather's time, the Core Sound region was one of the most well-known for boatbuilding. "At one time, there were 42 places on Harker's Island that were building boats," says Gillikin. Most were small operations crafting fishing boats and vessels for people to get on and off the island.

Further south, boatwrights were also hard at work. As far as Harold Varnum knows, boatbuilding in his family goes all the way back to his forefathers from Ireland who settled near Wilmington. That was three or four generations ago, and today the Varnum name remains synonymous with wooden boatbuilding in southeast North Carolina.

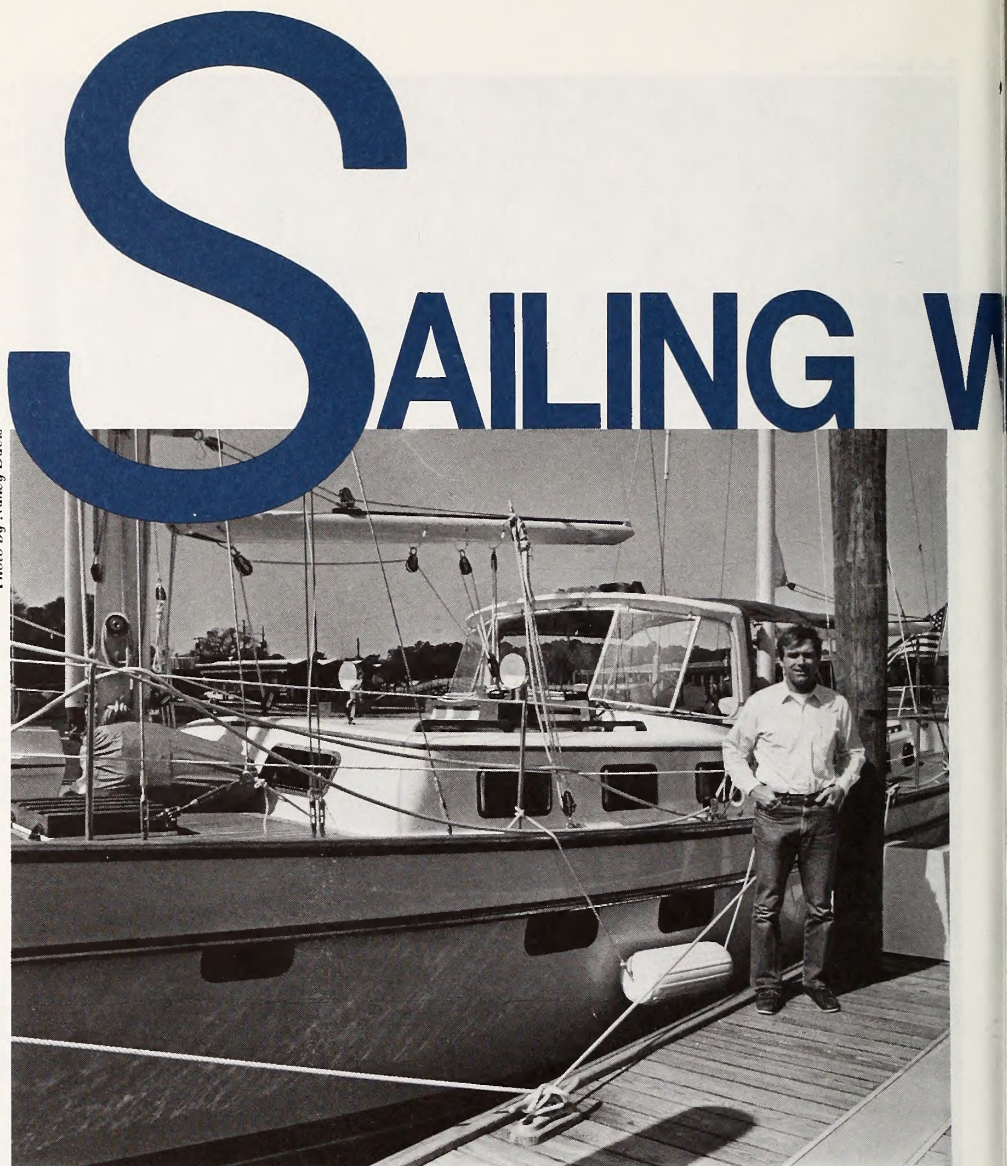
The tradition is part of the reason Varnum builds boats. For him, the real pleasure comes in the creating. "I love to create," he says. "I'm always creating something. It's hard work, but I like it."

Jimmy Gillikin feels the same way. "I just love to do it," he says. "You get a pile of lumber and you fix it into something that floats."



Walter Cronkite the sailor; boatbuilder Bob Yunaska shows off his pride and joy—Cronkite's Wyntje (right)

Photo by Nancy Davis



BY NANCY DAVIS

She's a 48-foot dream. A sailing yacht that took over a year to design and construct. A vessel that's got all the latest in rigs and electronic gadgetry. She's christened the *Wyntje*, and on this day, she's plying the waters around Wrightsville Beach. At the helm, her owner, Walter Cronkite.

That's right. After years of smooth sailing as the top-rated TV anchorman, Walter Cronkite has pulled up anchor and set course for a life of leisure on the water. He was making news in the Wilmington area recently when he stopped by to pick up his newly commissioned North Carolina-built sailboat.

With that, Cronkite joined the ranks of the famous and some not-so-famous folks who have chosen North Carolina boatbuilders to construct their boats... or yachts, that is.

For a look at what captivates a boater's interest in a luxury yacht built in this state, come aboard Cronkite's *Wyntje*. (The boat was named after the first woman to marry a Cronkite in the New World back in 1642.) Today, Cronkite and his wife have invited several friends, the boat's builder and one awed writer to join them. Most of the passengers were along for a short excursion; the writer was there for the trip of a lifetime.

On deck, the newsman is propped against the helmsman seat, the huge teak wheel in his hands. He's pushing buttons and checking monitors overhead. Clad in khaki pants, bright blue sweater, suede deck shoes and captain's hat, he's talking

TH AN ANCHOR

about the thing he loves to do most—sail. He hates the cabin cover overhead, he says; he'd prefer to have it open. But, in this chilly weather, it is convenient, he concedes.

Cronkite was taking the *Wyntje* on sea trials, getting the feel of the wheel, learning the operation of the equipment—said to be all the latest in electronics—and testing her performance. “We’re just getting to know each other,” he says. So far, Cronkite has logged in 52 miles.

Boatbuilder Bob Yunaska of Sunward Yachts in Wilmington stands by for his famous customer's comments. The Loran system isn't working properly, but the twin headstay rig Yunaska designed especially for Cronkite is performing well. Forever the broadcaster, Cronkite pulls out a small tape recorder to add to his “boat notes.” He records Yunaska's comments about special features of his sailboat for later study.

Cronkite's trust in his North Carolina boatbuilder shows through. “I like nothing better than to talk about this boat,” he says. “Bob has done some things with her that might turn out to be revolutionary,” says Cronkite, referring to the twin headstay rig that operates on a swivel, allowing for easy selection of a large sail for light wind or a small sail for heavier winds. The sails are operated with hydraulic winches.

Next, Cronkite invites you below deck where you enter the galley (that's boat talk for kitchen) and living area. Two staterooms (bedrooms) are located toward the bow of the boat, and the owner's stateroom and a small captain's berth are in the stern of the boat. The yacht is also equipped with two heads (bathrooms). The inside of the boat is finished in Honduras mahogany, and the closets are lined with cedar. This sailboat is nicer than most homes.

And what is the cost of all this luxury? Yunaska says prices for his 48-foot yachts start at \$340,000. And, that's with no extras.

Cronkite's boat was loaded with extras. For example, he wanted a centerboard, or retractable keel, added to his yacht—a feature not previously offered on Yunaska's boats. The centerboard would allow Cronkite better windward performance. Yunaska responded with a

design that incorporated the request.

Other features Yunaska built into Cronkite's design include a special windshield that will collapse outward in calm winds. In place, the windshield offers protection in the cockpit from stronger winds. A unique cockpit design includes a table and special links to all the navigational equipment.

Another Cronkite request was a removable dinghy, or lifeboat. It seems he's always bumping high dock pilings with his dinghy. The answer? Yunaska devised a setup that allows for a removable dinghy.

Cronkite's favorite contraption, though, is a gimbaled ballasted helmsman seat that will adjust to the motion of the boat. Cronkite pats the seat and says, “This is the *pièce de résistance* of Mr. Yunaska's engineering efforts. It'll be comfortable on a long tack.”

Yunaska says, “Some of these designs are a result of (Cronkite's) saying, ‘I'd like to have this, but the problems are this.’” Others are Yunaska's.

Of all the boats he's produced in his 10 years as a builder, Yunaska is most proud of the *Wyntje*. He pauses a moment, then repeats himself. “Yes I am. I am very proud of this.”

To demonstrate the workmanship in the boat, Yunaska points to the helmsman's wheel. “There are 78 pieces of wood in just this wheel,” he says.

Cronkite's *Wyntje* is one of two boats Sunward Yachts' 16 employees will turn out this year. So far, they've always had a backlog of work, and they've never had to advertise, says Yunaska. But then, who needs advertising when you've got Walter Cronkite steering one of your boats?

And even though it's a Sunward yacht, Cronkite's purchase is good news for other North Carolina boatbuilders. His well-publicized boat buy helps to put the state's craftsmen in the minds of other prospective buyers.

As the sun lowered in the sky, Cronkite carefully guided his new possession into dock. “It looks like it would be a good night for a moonlight cruise,” he says, gazing at the clear sky. A visitor resisted the temptation to say, “And that's the way it was, March 24, 1986.”



Craftsman in the Sunward Yachts workshop



DREAM BOATS



BY NANCY DAVIS

Photo from Hatteras Yachts Inc.



For sale: luxury home complete with living room/dining area, kitchen, three bedrooms, two baths and a deck. Amenities include air conditioning, heat, stereo in each room, video cassette recorder, washer and dryer, and a kitchen complete with dishwasher, trash compactor and ice maker.

Sound like the home of your dreams? Well, if you like the water and you've got a little extra cash, you could be in luck. This luxury home is actually a 53-foot cruising vessel built by Hatteras Yachts Inc. in New Bern. And, if you have to ask how much, well, it's probably out of your league.

Each year North Carolina boatbuilders turn out hundreds of pleasure custom- and semicustom-built boats. Some are cruising yachts or sailing yachts. Others are top-of-the-line sportfishing boats. Whatever their mission, these vessels have a reputation in the boating world for their quality and craftsmanship. What's more, their construction in this state contributes millions of dollars to the economy.

In a sharp contrast to the state's traditional wooden boatbuilding industry, these luxury vessels, usually made of fiberglass, attract customers looking for a little something extra in the boating experience. They also have plenty of money to sink into a boat.

At Hatteras Yachts, 750 employees turn out 80 to 100 cruising yachts each year. "When somebody orders a boat from Hatteras, it's like ordering a Mercedes Benz," says Baird Paschal Jr., manager of production control at Hatteras. "You have all of the options, and then we take it one step further and customize it."

The smallest boats built at the New Bern plant are 53-footers. Their base price, before the extras, is about half a million dollars, says Paschal. (If you choose to make a purchase, you'll need to travel to New Bern to cruise away on your boat; the highways just aren't big enough for such a delivery.)

For those recreational fishermen who like to fantasize about that special boat, stop in at Davis Yachts Inc. in Wanchese. There, workers complete one 47-foot sportfishing boat every four weeks and a 61-foot boat every eight weeks. The base price for the 47-footer is \$400,000. With extras, it retails at about \$465,000, a price that includes electronics and fishing equipment, says Buddy Davis, owner of the company. His 61-foot boat completely outfitted, costs an average of \$1 million.

Davis, once a charter captain, has combined a knowledge of sport fishing with his boatbuilding know-how to create vessels tailor-made for his target market, which he describes as "affluent sport fishermen." He adds, "They're simply avid fishermen. It doesn't matter if they're from Texas or New York. Their demands are the same."

The majority of Davis' sales are in New Jersey, southern Florida, Texas and Alabama. Most of his North Carolina customers are residents of the Research Triangle area, he says.

If you prefer the power of the wind, Bob Yunaska of Sunward Yachts in Wilmington may have the boat for you. There, his 16 employees turn out

two 48-foot sailing yachts each year. The hull and deck are standard; after that, only your imagination, and perhaps your pocketbook, will limit your options. His boats start at \$340,000 with no extras. These days, Sunward is best known for constructing Walter Cronkite's boat. (See story, page 4)

Prices of yachts constructed in North Carolina vary according to the amount of custom work in the boat. Some of the boats are completely custom-made; others start with a standard hull and offer variations from there. And although their markets differ, each of the boatbuilders agrees that communication between builder and buyer is central to the success of the luxury yacht business.

Much like building a custom home, the customer must be in touch with the builder at all times to make decisions about the interior design, types of masts and sails, and even styles of steering wheels.

Although there are some dreamers with the cash to back it up, most boaters have more aspiration than income. But take heart. Folks who can afford these yachts are by no means typical boat owners, and it is possible to buy a boat without spending your life's earnings.

According to a National Marine Manufacturers Association survey taken in 1981, boat owners in the United States were most often 35 to 40 years old with a working spouse and children living at home. The boat owner was a blue collar worker, and his median household income was \$30,000 a year.

The average boat owner only dreams of owning a 50-foot yacht. In reality, he most likely buys an outboard motorboat averaging 15.8 feet in length which, complete with motor and trailer, costs under \$5,000. When it comes to a luxury yacht, that's only small change.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



When it comes to filtering sewage, some soils just can't get the job done. The sandy soils of the coastal plain and the clay soils of the Piedmont and mountains pose problems for conventional waste treatment systems. Along the coast, loose, shallow soils frequently don't purify wastewater before it reaches the water table. And dense clay soils don't always allow the effluent to be absorbed. Instead, it rises to the surface.

To reduce the problems — polluted groundwater and restrictions on development — caused by the poor soils, a team of Sea Grant researchers developed some alternatives, the low-pressure pipe and mound systems. These systems pump doses of wastewater under pressure into shallow, narrow trenches.

Several years ago, Sea Grant published two manuals, *Design and Installation of Low-Pressure Pipe Waste Treatment Systems* and *Design and Installation of Mound Systems for Waste Treatment*, to familiarize engineers, sanitarians, contractors and architects with the construction of these alternative systems.

Now, Sea Grant is offering a third manual in the series, *Pressure-Dosed Septic Systems: Electrical Components and Maintenance*, written by Claude H. House and Craig G. Cogger of the NCSU Soil Science Department. This manual describes, in detail, the dosing controls and accessories needed for pressure-dosed septic systems and discusses how to select, use and maintain them.

For a copy of this publication, write Sea Grant. Ask for UNC-SG-85-06. The cost is \$3. For a copy of the low-pressure pipe or mound manual, ask for UNC-SG-82-03 and UNC-SG-82-04, respectively. The cost is \$2.50 for each.

North Carolina fishermen may be netting bigger profits this year if a new type of fishing gear proves efficient. Word has spread that floating pound nets may be a better choice than the traditional staked pound nets. With this in mind, Clinton Willis, president of the Carteret County Watermen's Association, asked Sea Grant agent Bob Hines to test the floating nets and bring back the results.

Hines says he plans to borrow the nets from Maine and test them in Carteret County this spring, summer and fall. Floating pound nets use floats and anchors to hold them in place instead of stakes, making them simpler to put out and take up, says Hines. And the absence of stakes will lessen navigational hazards for boaters.

For the full report on Hines' findings, watch the Back Page.



No one knows for sure how much shoreline the ocean will claim in the next 20 years. The extent of erosion depends on many factors, including the powerful winter storms that occur in eastern North and South Carolina.

A new research project on the Carolina coasts may answer some of the questions. Researchers from all over the country are studying the storms, hoping to improve the ways forecasters can predict when or where major storms will hit.

GALE — Genesis of Atlantic Lows Experiment — is a \$10 million project involving about 200 scientists, numerous universities, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration and the U.S. Air Force. The researchers want to find out how

the Appalachian Mountains, the coastal landscape and the Atlantic Ocean contribute to the formation of the winter storms that destroy oceanfront property, produce gale-force winds and cause beach erosion.

Len Pietrafesa, a Sea Grant researcher and N.C. State University professor, was part of the project. He studied the interaction of wind with the ocean currents and the heat and energy exchange across the surface of the ocean during the storms.

January through March, the team used weather balloons, research vessels, airplanes, weather stations, computers and radar to measure storm activity at the coast. Their compiled results should make a difference in understanding the force and timing of these large storms.



North Carolina ranks third on the Atlantic Coast in blue crab production. Since 1978, fishermen have reported record landings. But growth in the state's blue crab fishery affects more than just the fishermen. It impacts dealers, processors, managers and consumers.

In a working paper, *Social and Economic Impacts of Growth in the Blue Crab Fishery in North Carolina*, Sea Grant researchers assess the effects of this growth. John Maiolo, Claudia Williams, Ruth Kearns, Hubert Bean and Hih Song Kim, with the East Carolina University Department of Sociology, Anthropology and Economics, examine some of the social and economic parameters of the state's blue crab industry. And, the researchers offer a profile of a crab fisherman.

For a copy of the report, write Sea Grant. Ask for UNC-SG-WP-86-1. The cost is \$1.75.

Last year, most North Carolina shrimpers saw gold when they pulled in their nets. Shrimpers netted the second largest total catch in the state's history. In 1985, the fishermen caught

Continued on next page

10.8 million pounds of shrimp with a dockside value of \$19.1 million. The largest harvest was 14.6 million pounds in 1953.

What made last year so profitable? Conditions in the sounds were almost perfect for the young shrimp to grow, says Ed McCoy, assistant director of the N.C. Division of Marine Fisheries. Little rain and freshwater runoff, and a dry spring and summer kept water in the state's primary nursery areas at a high salinity level. The salty estuaries and an excellent survival rate helped increase the numbers of shrimp.

You've readied your boat for a summer on the sea, and you've charted your course. But before you climb aboard, there's more to remember than your deck shoes and cooler.

Don't leave the docks without knowing boating safety rules. The extra knowledge could save your life.

June 1 to 7 is designated as National Safe Boating Week. Bone up on safety

tips with a course offered by organizations such as the U.S. Coast Guard, the U. S. Power Squadron and the American Red Cross. In 10 weeks, boat owners and other sailors can learn about boat equipment and maintenance, first aid and the rules of the open sea. All courses are free.

To find out about the classes, call your local Red Cross, USPS office or Coast Guard station. Or call the BOAT/U.S. Foundation at 1-800-336-BOAT.

BeLinda Hoots is the new fisheries technician at Sea Grant's Aquaculture Research Center in Aurora. Hoots, a graduate of N.C. State University in fisheries and wildlife, obtained aquaculture training as a U.S. Peace Corps volunteer. She recently completed an assignment as supervisor of a fisheries development program in Sierra Leone, West Africa. Hoots will work with aquaculture agent Randy Rouse on Sea Grant's research with striped bass hybrids.

The Gramm-Rudman-Hollings balanced-budget act, formally known as the Balanced Budget and Emergency Deficit Control Act of 1985, affects everyone—including Sea Grant. In 1986, the National Sea Grant Program expects to receive a 4.3 percent cut in funds, says UNC Sea Grant Director B.J. Copeland. The National Sea Grant office is responsible for distributing funds to the various state programs including UNC Sea Grant.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, NC 27695-8605. Vol. 13, No. 5, May, 1986. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

COASTWATCH

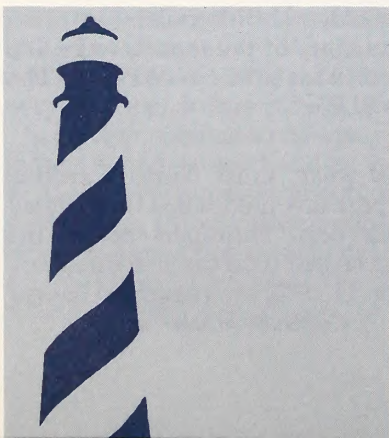
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COAST WATCH

Seafood Hooks America

**New respect
at restaurants
and supermarkets**

**Health food
for the heart**

**Advice from
a seafood expert**



*Waitress from More-
head City's Char-
ter Restaurant
is all smiles
over seafood*

*(Photo by Scott
Taylor)*

SEAFOOD

From coast to coast, more Americans are filling their plates with the fisherman's catch

By Kathy Hart

Photo by Kathy Hart



Rick Madden of Wellspring Grocery promotes his product

Like Cajun food, VCRs and BMWs, seafood is "in."

And it should be. Everyone from the American Heart Association to the local grocery store is promoting the ocean's bounty.

The public is bombarded with information about seafood—how good it tastes, how nutritional it is, how much variety it offers and how easy it is to prepare and cook.

The results?

Salmon steaks, orange roughy fillets and grouper nuggets increasingly fill the plates of young urban professionals. Per capita consumption in the United States increased from 13.6 pounds in 1984 to 14.5 pounds in 1986.

Seafood retailers say this is just the beginning. Rural, central and mid-western U.S. markets are yet to be fully developed.

But fish and shellfish may need the promotional boost.

Not long ago, most Americans shunned

seafood, particularly for cooking at home. They remembered their mothers frying flounder or perch to a crisp, then burning incense to mask the odor.

It was enough to leave a bad taste in anybody's mouth, especially when the fish was less than fresh.

But the seafood business is changing.

From the fisherman to the retailer, fish and shellfish receive better treatment. More care and better handling have improved the condition in which the fisherman's catch arrives at retailers and restaurants. Air freighting allows today's catch of West Coast salmon to be served on East Coast tables tomorrow.

Once the product is improved, the key is getting the consumer to taste the difference.

The public will sample the catch if it comes from a restaurant kitchen. Surveys show that about 75 percent of the seafood eaten in America today is consumed in restaurants.

From the independent operation to the large chain, restaurants are including more seafood on the menu. And they are turning away from fried fish, french fries and coleslaw, says Carol Stigelman, seafood development specialist with the N.C. Division of Marine Fisheries.

Diners are tempted by barbecued shrimp, blackened redfish, grilled swordfish steaks and steamed king crab fresh from Alaska.

Many supermarkets bank on the consumer's growing hunger for fish and shellfish. Surveys show that 17 percent of the nation's retail food stores have installed seafood service counters.

Clearly, seafood has moved out of the meat counter. Supermarkets that are serious about seafood sell it at attractive full-service counters.

Larry Poos, seafood specialist with Harris Teeter, says his company is experimenting with an updated look for its seafood counters. In a test store, retailers are fashioning the counter into an undersea world, placing the commodity on shaved ice around an ice sculpture.

The payoff: a doubling of seafood sales.

Who's Eating Seafood?

Female over 35. Has college education. Lives in Northeast. Income of \$34,000. Seeks a tasteful relationship. Respondents should have clear eyes and firm bodies. For a sizzling evening, write Box.....

What's the catch?

Flounder, grouper, sole or tilefish.

The woman in this fictitious ad is angling for dinner. And she represents the typical seafood consumer in America.

As grocery stores and restaurants make more effort to promote fish and shellfish, they want to know who eats the catch and what species the public likes the best.

The National Marine Fisheries Service and the Food Marketing Institute surveyed Americans to find some answers.

The NMFS survey, completed in 1984, showed that the typical seafood consumer:

- * possesses a high school education or above,

- * resides along the East coast,

- * Lives in a metropolitan area of 500,000 or more people,

- * earns a yearly income between \$25,000 and \$35,000, and

- * is white non-Hispanic.

In a survey of supermarket seafood shoppers, the Food Marketing Institute found that 40 percent of the buyers earn over \$35,000 a year, and 52 percent are between the ages of 25 and 44.

What seafood is America's favorite?

Shrimp.

It fills more plates than any other fish or shellfish. Second choice is fresh and frozen white meat fillets, such as scrod, cod, flounder and haddock.

Consumers do favor a few red- or pink-meat fish, such as salmon and mackerel. And cheaper, surimi-based products are becoming palate pleasers.

"Fifty percent of the sale is in the presentation," says Sea Grant researcher Tyre Lanier. "The seafood can't drip or smell. It has to look good."

Education is another key factor in selling the public on fish and shellfish, says Joyce Taylor, Sea Grant's seafood education specialist.

"Most consumers aren't comfortable with seafood," she says. "They don't know how to buy it, and they don't know what to do with it when they get it home."

To help shoppers, Taylor has written several seafood consumer guides (A North Carolina seafood seasonality poster, UNC-SG-84-04; Hooked on Fresh Fish, UNC-SG-85-08; and Dressing Finfish, UNC-SG-86-10). And she has more planned.

But Taylor can't educate the public alone. The person behind the service counter has to know his seafood.

Rick Madden buys and markets the products he stocks in his seafood counter in Durham's Wellspring Grocery, a store specializing in natural food.

"I find that my customers want to add more seafood to their menus, but they know next to nothing about it," he says.

So, Madden supplies the missing ingredient—information.

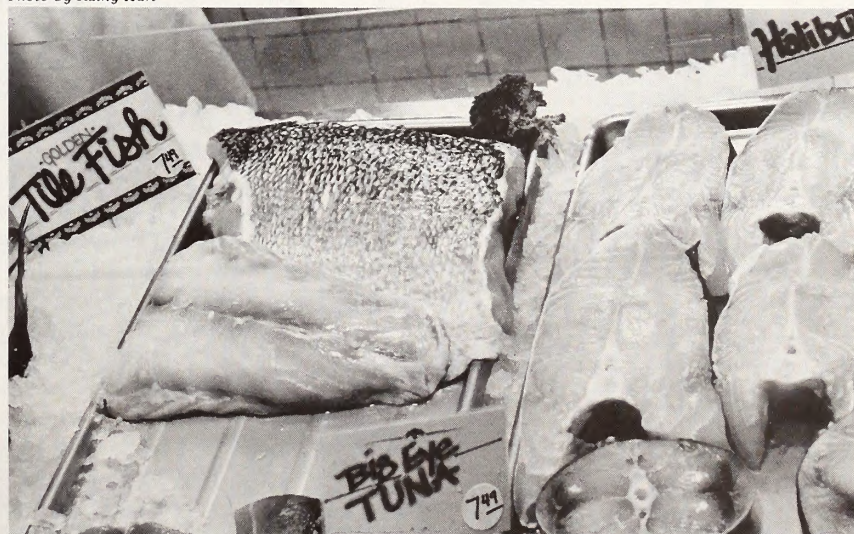
Drawing on the fish and shellfish reference books and cookbooks behind the counter, Madden tells people about the attributes

of golden tilefish, gray trout, orange roughy, and king mackerel. And he provides recipes to go along with the purchase.

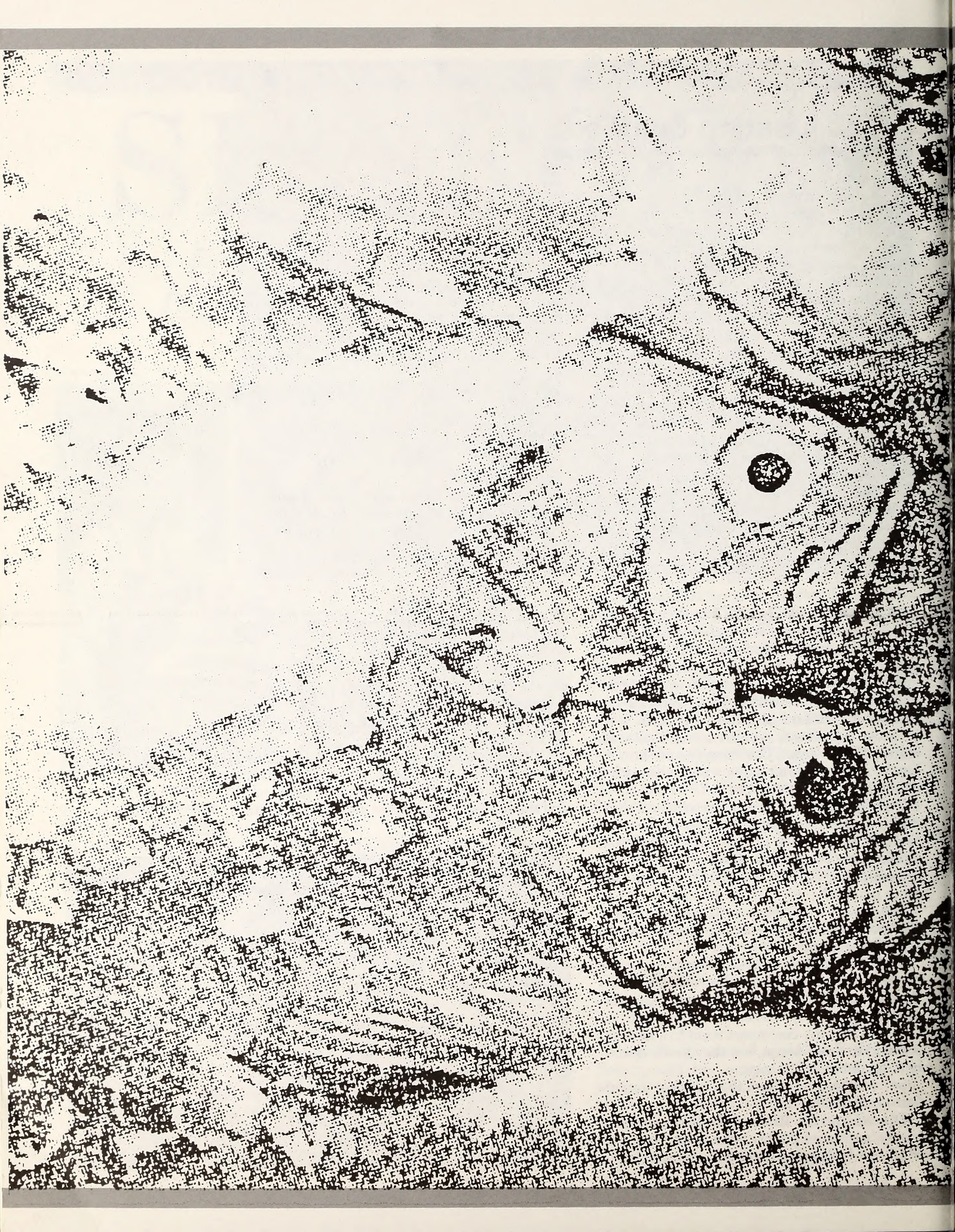
"I tell people how fast and easy it is to prepare seafood. On the average it takes about 10 minutes to cook, and it should be the last thing you cook before you sit down at the table," he says.

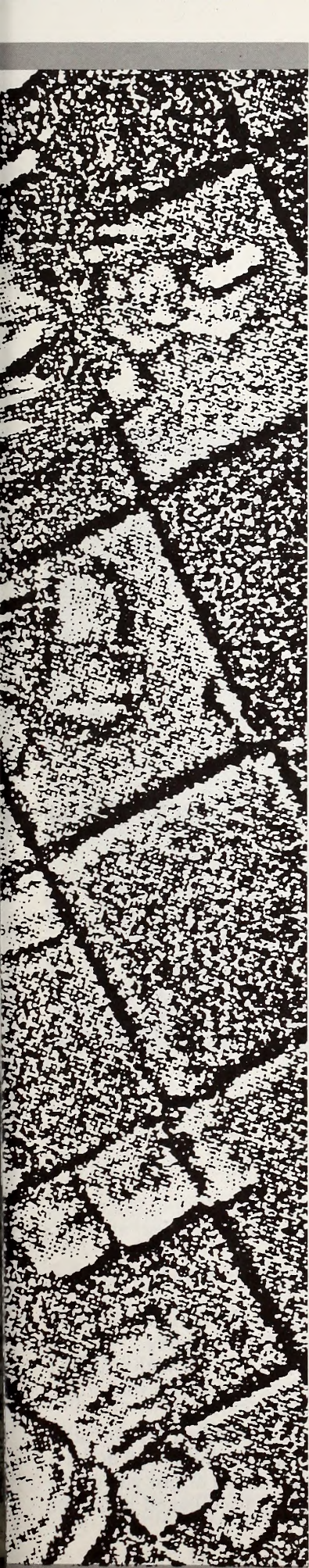
"It's not like beef or poultry. When you buy different cuts of these meats, you're still getting beef and poultry. But every fish is different, and there are so many more things you can do with fish."

Photo by Kathy Hart



Grocers are improving display counters





H

EART FOOD

By Nancy Davis

Old wisdom held that seafood was brain food. Then nutritionists discovered that it beat beef as a mainstay in the American diet. Now doctors tell us that a good thing is even better.

Seafood is heart food.

So says *The New England Journal of Medicine* in its May 9, 1985, edition.

New evidence shows a link between seafood consumption and a low death rate from heart disease. For years, doctors have known that seafood is low in fat, calories and cholesterol and high in protein and minerals. But they warned against seafoods with a high fat content such as salmon, tuna and mackerel.

Now they say these fish are not only safe to eat, they're urging us to replace meat and poultry with fish and shellfish at least twice a week.

The report made the front pages of the country's major newspapers, and television network news covered the story. Eat fish to your heart's content was the message, and the nation's seafood lovers took the advice to heart.

In 1984, per capita consumption of seafood in America was 13.6 pounds. By 1985, it had risen to 14.5 pounds.

Oils in the seafoods contain fatty acids that can lower harmful fats and cholesterol in the blood and reduce blood clots. The ultimate benefit may be a lower risk of heart disease and stroke, says Sea Grant's Joyce Taylor.

Doctors had suspected the relationship between seafood consumption and coronary health. In societies such as the Greenland Eskimos, in which seafood composed most of the diet, heart attacks were virtually unknown.

With this in mind, a group of doctors set out to find the link. They studied 852 middle-age men without heart disease in the Netherlands. The researchers collected dietary information on their subjects in 1960 and studied them for 20 years. In the two decades, 78 men died from heart disease.

The clincher: "Mortality from coronary heart disease was more than 50 percent lower among those who consumed at least 30 grams of fish per day than among those who did not eat fish," the doctors say in the *Journal* article.

"We conclude that the consumption of as little as one or two fish dishes per week may be of preventive value in relation to coronary heart disease."

The study discovered the unique character of fats in seafoods, says Taylor. Fish and shellfish contain high levels of polyunsaturated fats, those capable of lowering cholesterol levels. Saturated fats found in red meat increase cholesterol levels in the blood.

For example, 4 ounces of boiled cod contain .1 to .2 grams of saturated fat. The same amount of ground beef contains about 11 grams.

Studies show that for every 1 percent reduction in cholesterol level, we get a 2 percent reduction in the risk of heart attack, Taylor says.

Oils made from corn, cottonseed, safflower, sesame seed, soybean and sunflower also are high in polyunsaturated fats. But seafoods contain a special class of the fats, called omega-3 fatty acids.

The omega-3's help to reduce the chance of heart attack by reducing fatty deposits that collect on artery walls. Omega-3's occur only in the oils of fish or marine animals. Oily, fatty fish are the richest sources. Of course, eating fattier fish may mean consuming a few extra calories.

But Taylor says, "Even the fattiest fish contain less fat than red meat."

With the new evidence, fish oils are touted as a cure-all for everything from high blood pressure to migraine headaches.

Taylor says, "I get scared when people say, 'If I eat fish twice a week, I'm not going to have a heart attack.'"

Smokers, for example, still run a greater risk of heart attack.

The best approach is to improve your diet, increase exercise and stop smoking. The benefit of fish oil comes from substituting it for the foods that promote heart disease, Taylor says.

JOYCE TAYLOR

Takes seafood out of the deep fat

By Nancy Davis

Ounce for ounce, in the quest for good health, seafood beats red meat hands down.

But sprinkled with salt, dipped in batter, fried in deep fat, the sea's bounty loses its edge.

You've just turned a healthy meal into one full of fat and calories, says Joyce Taylor, Sea Grant's seafood education specialist.

Taylor's message: Seafood can be a delight to the palate without becoming a disaster to good health.

All you have to do is change the way you cook it. You're bound to make a few mistakes at first, so Taylor has some tips that may help.

"If it smells fishy, avoid it. Anyway you cook it is OK, except for frying. And don't overcook it."

And rule one is that seafood must be fresh. A fish that isn't fresh won't taste good, no matter what you do to it.

"Have you found a way to cook fish to make it not taste like fish?" someone asked her once in a workshop.

"Have you found a way to cook turkey so that it doesn't taste like turkey?" Taylor responded. Most people who don't like the taste of fish have never had fresh fish, she says.

Use your nose to determine freshness, Taylor says. Fish and shellfish should smell as though they were just pulled from the water. A "fishy" odor is a sign that seafood is old.

After you've chosen a fresh product, don't ruin it when you cook it, Taylor says.

The most common cooking mistakes? Oversalting, breading or battering, frying in oil and overcooking.

According to Taylor's rules of seafood cookery, deep frying is culinary blasphemy and no way to treat a fish.

"I meet a lot of people who tell me they're on a diet, so they eat a lot of fish. When I ask them how they prepare it, they say they roll it in cornmeal and fry it up. Now that's not a low-calorie food," Taylor says.

With the drop of a fish into deep fat, you can add as much as 12 percent more fat to the fish, Taylor says. And the extra fat means more calories and cholesterol.

Instead of deep-frying or pan-frying, Taylor recommends poaching, steaming, baking, broiling, barbecuing, stir-frying or oven-frying.

And instead of topping fish with a cream or butter sauce, try herbs and spices. They won't disturb the delicate taste of the seafood.

Avoid oils that are animal fats, Taylor says. That includes butter.

"There's nothing better together than butter and seafoods," says Taylor. But she recommends a low-calorie, polyunsaturated margarine or vegetable oil.

Oversalting seafood is another common cooking mistake.

Photo from The Charlotte Observer



Usually you can do without it, Taylor says.

"First I cut the amount of salt in a recipe in half, and nobody noticed it. So I cut it in half again, and still nobody noticed it," she says.

As alternatives to salt, Taylor uses herbs and spices and white wine as a broth. A celery sprig with a leaf attached will release a salty flavor.

The worst offense committed against seafood is overcooking.

Fish cooks quickly, and overcooked fish becomes dried out. Taylor advises checking the fish frequently.

The fish is done the instant it flakes easily with a fork or when it turns opaque. Cooking time varies according to the temperature and method of cooking.

Side dishes need improvement, too. Baked corn bread is lower in fats and calories than hush puppies fried in deep fat. You can use low-calorie mayonnaise or just vinegar to make slaw. Instead of french fries, try a baked potato or wild rice.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



UNC Sea Grant's monthly newsletter *Coastwatch* was awarded a silver medal for excellence in writing, editing, design, photography and printing.

Coastwatch was among 60 entries nationwide in the competition sponsored by the Council for the Advancement and Support of Education.

Judges honored the newsletter for its in-depth coverage of coastal topics. *Coastwatch* writers explored the geologic history of the state's coastal plain. They updated their readers on new seafood products. And, they reported the findings of a Sea Grant research project on clam harvesting methods.

Other Sea Grant publications were honored in a technical art competition sponsored by the Carolina Chapter of the Society for Technical Communication. They included: 1) *Amberjack*, a poster promoting the underutilized fish—award of excellence, 2) *Sea Grant in North Carolina 1983-1984*, an annual report cover—award of excellence, 3) *Hooked on Fresh Fish and Shellfish*, a consumer's guide to seafood—award of merit, and 4) *Sheepshead*, a brochure promoting another underutilized fish—award of merit.

Shrimp is America's favorite seafood. But how can you fill your freezer with this tasty crustacean and not empty your pockets?

Catch your own.

Sea Grant's new booklet, *A Guide to Recreational Shrimping*, will tell you how. Written by advisory agent

Wayne Wescott, the booklet covers everything from regulations to culling the catch.

Using step-by-step descriptions and diagrams, learn to build and outfit trawl doors, to rig a trawl and to construct a mast. Wescott describes how to spot problems with your nets, lines and doors. And he reveals what times of the day are best for trawling.

Wescott provides tips backed by years of his own shrimping experience and that of other recreational shrimpers. For instance, he takes the hassle out of figuring door sizes, tickler chain lengths and towing times.

For a copy of this 36-page illustrated booklet, write Sea Grant. Ask for UNC-SG-86-07. The cost is \$4.



Take a cup of tradition. Add some of coastal Carolina's most colorful personalities. Mix in their favorite recipes. Bake for a few years, and you have a cookbook called *Coastal Carolina Cooking*.

Coastal Carolina Cooking, which was published by the University of North Carolina Press in Chapel Hill, was written by Sea Grant writers Nancy Davis and Kathy Hart.

In its pages, you will meet 34 cooks from Currituck County to Brunswick County and everywhere in between. They shared the dishes you won't find on restaurant menus or in the pages of fancy cookbooks. The recipes start with the basics and almost never call for ready-made ingredients.

Taste the goodness of clam chowder with cornmeal dumplings, flounder stuffed with crab dressing, fried okra and blueberry dumplings.

And meet Frances Drane Inglis of Edenton, Letha Henderson of Hubert and Mitchell Morris of Smyrna. They shared not only their recipes, but the family history and tradition that surrounded food preparation and eating.

For a copy of *Coastal Carolina Cooking*, check your local bookstore or write the UNC Press, P.O. Box 2288,

Chapel Hill, N.C. 27514. Prices are \$14.95 for the hardback and \$8.95 for the paperback. Add \$1.50 for postage for the first copy and 75 cents for each additional copy. North Carolinians must add 3 percent sales tax. Mail orders must be prepaid by check, VISA or Mastercard.



The winds have reached 50 mph and the water has risen 2 feet above its norm. Your \$60,000 boat thrashes in its slip like a wild horse in a stall.

The wind unleashes, clocking 100 mph. The water rises. But your boat lines are tied too tightly, and the wild horse wants to cut loose.

Instead, the taut reins pull the dock pilings over. Your boat ricochets off the boats nearby. Before long your boat and several others have huge gashes in their sides. They sink.

Whether you own a catamaran or a 60-foot yacht, a hurricane can destroy your boat. But a few simple steps can safeguard your vessel if you meet a storm eye-to-eye.

Sea Grant has a new poster to help recreational boat owners prepare for a hurricane. It offers tips for checking your gear, removing equipment, securing the boat and more. The poster, which was developed by Sea Grant marine agent Jim Bahen, has a checklist for small-boat owners and for sailboat and large-boat owners.

Hang a copy of this graphic 17-by-24 inch poster in your garage or marina. It could make a difference the next time a hurricane strikes.

Single copies are free. To obtain, write UNC Sea Grant and ask for UNC-SG-86-08.

Aquatic weeds can choke a pond. Each year, the nuisance vegetation takes over more of the state's ponds and reservoirs. Thick mats of vegetation obstruct the paths of fishermen, boaters and swimmers. Withdrawing

Continued on next page

water for irrigation, drinking or industrial use is hampered by pipes clogged with the weeds.

The solution?

Associate Sea Grant Director Ron Hodson believes the answer may be a fish that will eat the vegetation. And he's written a Blueprint, *Using Grass Carp to Control Aquatic Weed Vegetation*, that outlines the use of carp to reduce vegetation in ponds.

Hodson says grass carp eat a variety of aquatic plants, including hydrilla, widgeon grass, coontail and duckweed. In some cases, there is a noticeable reduction in vegetation within four months.

In the Blueprint, Hodson describes the biology of the grass carp and its effectiveness against some aquatic weeds. He recommends stocking sizes and rates and offers tips for getting started and for obtaining the necessary permits.

For a copy of the four-page publication, write Sea Grant. Ask for UNC-SG-BP-86-1.



Every summer there's a mystery at the beach. The clues are hidden in the surf. And if you don't watch out, they may get under your skin.

The mystery begins when you dive in the ocean. Tiny needles seem to make an attack. Pink spots appear on your chest and belly. Then the itching begins.

The culprits?

Microscopic blue crab larvae.

These larvae, which look like tiny shrimp, have two sharp spines on their heads. When your hand or swimsuit presses against them, the spines prick your skin.

"It feels like stinging nettles almost, but it's not," says Lundie Spence, Sea Grant's education specialist. It's more like a small pinprick; then salt gets into it, too.

The larvae concentrate in the Carolina surf during June and July, Spence says.

Early in the year, blue crabs lay eggs nearshore and in the inlets. The eggs mature into larvae that migrate inshore in the summer.

If you have allergies or sensitive skin, Spence suggests avoiding the water when the larvae are concentrated.

For other beachgoers, she recommends rinsing after swimming and applying anti-sting cream if a rash appears. Over-the-counter creams with cortizone are best.

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COAST WATCH

A force that can bring down the house

HURRICANE





A PROFILE OF Destruction

Hurricanes pose a greater threat to coastal North Carolina today than ever before.

No more intense or more frequent than 20 years ago, hurricanes simply have more homes, condominiums and buildings to slam into.

Billions of dollars in real estate stand vulnerable. Each new house or condominium makes the stakes higher.

Even a mild hurricane such as Diana in 1984 caused over \$70 million in damages.

This month, *Coastwatch* wants to help coastal homeowners reduce the risks from hurricanes. This issue examines storm-resistant building techniques and building code standards for coastal construction.

But no home can be made hurricane-proof.

That's why you should heed warnings to evacuate.

Do what you can to reinforce your home. But leave your house to fend for itself when a hurricane approaches.

Here's what your house will be up against.

The winds. The very definition of a hurricane says the winds exceed 74 mph.

Researchers say the ratio of wind speed to damage goes like this: At 50 mph, minor wind damage can occur. When winds exceed 80 mph, expect the loss of windows,

shingles and gutters. At velocities over 100 mph, entire roofs and other structural elements are susceptible to damage.

But even more important, hurricane winds can launch a destructive barrage of missiles—lawn chairs, signs, roofing and metal siding.

The storm surge. It is the rise in water level that occurs as the hurricane moves onshore. It does not include the waves that ride atop it.

This dome of water, which can exceed 15 feet, is a hurricane's most destructive force.

The surge can undermine houses by scouring away sand. And it can tug and pull at walls, pilings and foundations, causing them to collapse.

The waves. Hurricane waves can reach 35 to 40 feet in height.

But that's only half of it.

Water weighs about 1,700 pounds per cubic yard. Throw that weight against a building over and over, and you have a nature-made hammer that can demolish any structure not specifically designed to withstand such force.

Add them up—winds, waves and storm surge—for a destructive combination called hurricane.

Diana

The Sound and The Fury

By Sarah Friday

She was no lady. But Marcus Rich will never forget her.

From his home in Wilmington, he watched her run her mighty fingers through the pines; marveled at her wanton power.

Her breath was like a freight train's whistle charging across the land.

He'd never met a lady like this. And it left him scared.

Photo from National Oceanic and Atmospheric Administration



The lady was Diana, the fourth hurricane of 1984. Her visit to the Carolina coast convinced Marcus Rich that homeowners can run from a hurricane, but their homes can't.

When Rich began construction of a new home last year, he used building techniques designed to increase the chances that his home could survive next time.

Hurricanes are inevitable. But the extent of the damage left behind may depend on a few simple, but fortifying building practices, says Spencer Rogers, Sea Grant's coastal engineer.

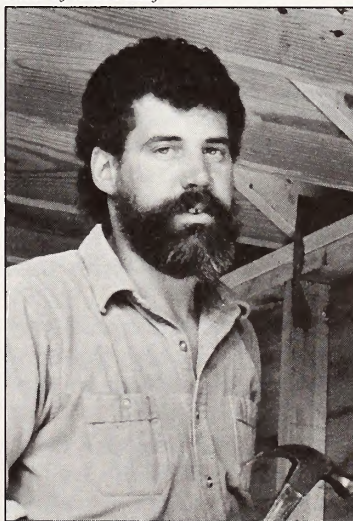
Rogers helped Rich decide just where those fortifying touches were needed.

"A lot of it's just overlapping—using a little more wood, a few more nails," says Rich. "It didn't make much difference financially, but it did structurally."

The whole idea behind making a house storm-resistant is making sure it's well connected. Houses near the coast should be tightly

Continued on next page

Photo by Sarah Friday



Marcus Rich (above); Hurricane Diana as she swirled landward in 1984 (left)

A CONSTRUCTION CHECKLIST

Any coastal home, new or old, can be made storm-resistant.

A little added effort and a few extra dollars could save you thousands of dollars in repairs after the hurricane.

If you're planning to build a beach house, consider the following tips before choosing a lot.

- **Erosion.** On the average, 3 feet of the state's shoreline erode each year. In truth, some areas develop 7 or 8 feet of sand; others erode 15 feet or more. To find the erosion rate for a specific area, check with an N.C. Division of Coastal Management permit officer.

- **Inlets.** Beware of building near inlets. One hefty storm can close or open an inlet, and inlets are always shifting.

- **Dunes.** Choose a lot that has dunes and vegetation. Natural shoreline protection can reduce the impact of storm waves.

- **Storm surge.** Know the highest storm surge level recorded for your area. Records are available from local building inspectors. These flood maps show water levels and should not be used to gauge erosion.

- **Flood insurance.** Check to see if your community qualifies for Federal Flood Insurance. Flood damage is not covered by normal homeowner's insurance. But you may obtain coverage for floods from your insurance agency if your community meets federal standards. Buying flood insurance early may lead to better financing.

- **Building regulations.** Before designing your home, know the regulations that govern

coastal construction. Check with the building inspector in your area for local housing ordinances and state building code requirements. If you're buying beachfront property, see a Division of Coastal Management permit officer for setbacks—the distance the house must be “set back” from the beach.

In addition to the building code requirements, consider the following storm-resistant building techniques. Rogers says these techniques can be used during construction or later to reinforce an older home.

- **Roofs.** Do not allow roof overhangs to jut more than 2 feet beyond the house. Long overhangs can allow hurricane-force winds to rush underneath and lift the roof.

- **Connections.** Reinforce connections between the roof and walls and between walls and the foundation with stainless steel straps or wooden wind anchors. “Toenails,” or nails driven diagonally through perpendicular boards, are weak connections that can fail in a hurricane.

- **Corrosion.** Stainless steel straps and wooden wind anchors are corrosion-resistant. Along the beach, corrosion can destroy regular metal straps in three to five years. (For more information about wooden wind anchors, ask for Blueprint UNC-SG-BP-84-3).

- **Windows.** Install windows that will keep out blowing rains. Add storm shutters to protect the windows from flying debris.

- **Roof vents.** Cover roof vents, especially in gabled roofs, to keep out blowing waters from high winds.

secured from the pilings to the roof.

Rich's house was on high ground and did not need pilings. So the crew started with the foundation.

They set three layers of concrete blocks for the foundation and poured concrete through all of them. They screwed long bolts down the middle to make the blocks stand firm.

They completed the frame of the house, then sheathed it entirely in plywood. Usually, builders use plywood only at the corners for reinforcement. But the sheets better protect the frame, and it should hold up when Rich's house faces 100 mph winds again.

Inside, Rich used metal straps to connect the

roof frame to the second-story walls. Rogers recommends wooden wind anchors or stainless steel straps as sturdy, corrosion-resistant alternatives.

Outside, Rich plans to add functional shutters on all the windows. During Diana, he put plywood over the windows in his old house to keep them from shattering.

“That was a lot of trouble,” Rich says. “Shutters will do a better job.”

These tips and regulations are the minimum standards for protecting your house, Rogers says. Anything extra you do will increase the chances that your home will survive a hurricane.



The Carolina Code

A better foundation for construction in coastal North Carolina.

By Kathy Hart

A hurricane named Hazel slammed 120 mph winds and a 15-foot wall of water against North Carolina's southern beaches Oct. 15, 1954.

On Long Beach, only five of 357 buildings were left standing.

Five other hurricanes followed in the next six years. Each took its toll on coastal homes, and each delivered a lesson.

Coastal structures weren't built to withstand the fury of hurricanes. Even strong northeasters posed a threat.

After Hurricane Donna in 1960 and the Ash Wednesday northeaster in 1962, the N.C. Building Code Council realized that a different set of standards was needed for coastal construction.

Six years later, North Carolina became one of the first states in the nation to set up guidelines for coastal residential construction. The guidelines were optional and applied only to homes built on the Outer Banks or east of the Intracoastal Waterway.

They called for:

- pilings to be sunk 8 feet in the ground,
- the floor foundation to be 2 feet above the site's highest recorded storm surge, and

- the building to be strongly connected from the top of the roof to the bottom of the pilings.

It would be 18 years before the guidelines would become mandatory. But homeowners and builders began to comply. They mounted their houses on pilings, sunk the pilings deep into the sand and tied roofs to walls and walls to foundations.

"The image of the typical beach house changed," says Spencer Rogers, Sea Grant's coastal engineering specialist.

"People wanted to buy beach houses elevated on pilings with underhouse parking because that was their idea of what a beach house looked like on the North Carolina coast. They probably didn't connect that image with hurricanes. But at least they were making the right choice."

North Carolina building codes were years ahead of the rest of the nation, Rogers says. It was the mid-1970s before the Federal Flood Insurance Program coerced coastal localities nationwide into tougher building requirements.

But Rogers saw ways that the North Carolina code could become even bet-

Continued on next page



Spencer Rogers

ter. In 1980, he worked with the building code council to remedy a problem he saw frequently in coastal houses—overnotched pilings.

To connect the floor foundation to the piling, builders often sawed out a large section of the piling's top to create a ledge for the floor joists. In strong winds, these notched pilings snapped, and the house fell.

The council changed the code. Now, no more than 50 percent of the piling top can be cut away.

In 1983, the council decided to revise the coastal construction standards.

Rogers helped draw up changes that would make coastal homes stronger. "The old code was pretty good for most buildings," says Rogers. "But it had some weaknesses.

"Sinking pilings 8 feet in the ground is a good standard. But for erosion-prone beachfront areas, 8 feet is not enough."

Other construction techniques, such as bracing buildings with plywood, became standard. But the practice, which resulted in a more secure building, was not part of the building code.

And Rogers opened the council's eyes to the effects of corrosion on coastal construction.

Corrosion can weaken the metal straps and joists hangers used to strengthen building connections against hurricane-force winds.

The day the recommendations were delivered to the council, Hurricane Diana began churning the waters off the North Carolina coast.

The building code was hours away from its first test.

Diana pushed ashore with 100 mph winds but very little storm surge. Afterward, Rogers joined homeowners, building inspectors, insurance adjusters and designers in inspecting the damage.

"Out of several thousand buildings, only 136 were observed and inspected with structural damage," Rogers says.

In contrast, a hurricane of similar intensity, Alicia, made landfall at Galveston Island in Texas in 1983. There, about 35 percent of the 3,000 houses located in the West Beach community were destroyed beyond repair.

Federal flood insurance standards required West Beach buildings to be built above the anticipated storm surge. But few other construction regulations were enforced.

North Carolina's rigorous standards clearly made the difference. But Rogers cautions that Diana was an easy test.

The building standards were designed for 120 mph winds.

"Diana's estimated winds of 90 to 100 mph provided only 70 percent of the actual design conditions," Rogers says. "The extra 30 percent would have undoubtedly caused more severe damages."

Even after the good news from Diana, the council revised the building standards and made them mandatory as of Jan. 1, 1986.

The code now requires beachfront homeowners to sink pilings 5 feet below sea level or 16 feet below ground level, whichever is more shallow.

In addition, the code instructs contractors to frame buildings with plywood and to take into account the effects of corrosion.

"We're pleased with the code as it stands now," says Jess Allred, chief code consultant for the N.C. Department of Insurance. "It's not foolproof. Every house can't stand up to every hurricane, but the majority of them should stand the test."

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



It's 95 degrees. The sun shoots its scorching rays down on you like a .44 Magnum. It blazes your skin and burns your eyes.

The laser-like rays have the same effect on your eyes as on your skin, doctors say. To prevent problems, sun-seekers should take similar precautions with their eyes.

A new Sea Grant Blueprint, *The Sun and Your Eyes*, offers practical eye care advice for fishermen, lifeguards or others who spend their days in the sun. It includes methods for soothing sun-strained eyes, tips on buying sunglasses and a list of sun-related problems that can occur.

For a copy of this free, one-page guide, write UNC Sea Grant. Ask for UNC-SG-BP-86-2.

When the first tropical storm was named earlier this year, the telephones at the National Weather Service began ringing. Folks were calling a number set up by the National Weather Service to find out more about Andrew.

For the latest tropical storm and hurricane advisory, you can call 1-900-410-NOAA. A recording by a forecaster from the National Hurricane Center in Coral Gables, Fla., will give you an update on the storm.

Each call will cost 50 cents for the first minute and 35 cents for each additional minute.

The system will only be activated when there is a named tropical storm or hurricane.

It's hurricane season again. And this could be the year when another Hazel strikes our coast.

Will you be prepared?

To make sure, send for *About Hurricanes*, what to do and when to leave. The brochure tells you what to expect when a hurricane strikes, how to plan ahead, what to do if one is forecast, and what to do after the storm.

The brochure also includes a large tracking map that can be used to follow the progress of the season's hurricanes.

For a free copy, write Sea Grant. Ask for *About Hurricanes*.



Sea Grant and the N.C. Bar Association will present a conference on coastal environmental laws and procedures Oct. 3 and 4 at the Crystal Coast Civic Center in Morehead City, N.C.

The one-and-a-half day program will focus on laws and regulations controlling development, especially those related to water quality, wetlands and public trust areas.

The first day, participants will discuss a case study representing a major coastal development project. The study raises many issues encountered in coastal development.

The second day's agenda focuses on the administrative process. Topics include how regulations are made, how the public may become involved in rule-making, and what remedies are available to parties affected by enforcement (or lack of enforcement) of regulations.

Hotel accommodations are available at the Holiday Inn in Atlantic Beach, and at the Lord Carteret in Morehead City. Reservations should be made before Sept. 19.

For tuition rates or more information, contact Jim Hatch, Office of Continuing Legal Education, N.C. Bar Association, P.O. Box 12806, Raleigh, NC 27605 (919/838-0561). Or contact Walter Clark at Sea Grant.



Teach a youngster about the marine environment.

Coastal Capers is a booklet written and designed to help teachers, parents and scout leaders educate children 5 to 11 years old about the coast.

Through a series of 20 fun but educational "capers," adults can open a child's eyes to the buoyancy of salt water, the differences in sand and the art in shell shapes.

Written by Sea Grant marine education specialist Lundie Spence and teacher Vivian Barbee Cox, the capers take complicated concepts and make them easy and fun to learn.

For instance, teach kids about the food web. All it takes is a group of enthusiastic youngsters, several balls of different colored yarn and a little knowledge of what creatures eat.

Or how about teaching 8-year-olds the concept of overfishing and resource management. It takes only a bowl and several bags of goldfish crackers.

Coastal Capers is chocked full of art that can be reproduced with a photocopy machine.

For a copy of the booklet, write Sea Grant. Ask for UNC-SG-84-05. The cost is \$3.50.

The National Coastal Resources Research and Development Institute in Newport, Ore., is accepting proposals for research projects. The center funds multi-disciplinary studies of coastal and marine problems.

Research proposals should be national in scope, demonstrate a high potential for success and show that the research will benefit the economies of coastal regions.

Sea Grant Director B.J. Copeland and Sea Grant researcher Mike Orbach are on the institute's 15-member advisory board.

For copies of proposal forms, write Joye Stephenson at Sea Grant.

Continued on next page

Thirty feet beyond the shore, the water turns a deep, dark blue. The waves break haphazardly and send floating objects out to sea. A powerful tugging force lurks beneath the surf, hidden from unsuspecting swimmers.

Rip currents can be deadly. But with a little know-how and a level head, victims can swim to safety.

A new Sea Grant poster describes the currents, how to spot them, and what to do when caught in them.

The poster is free. Write Sea Grant and ask for UNC-SG-86-09.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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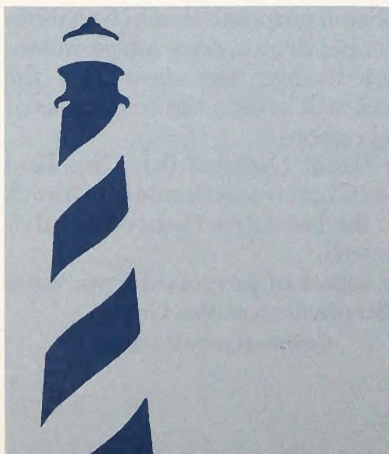
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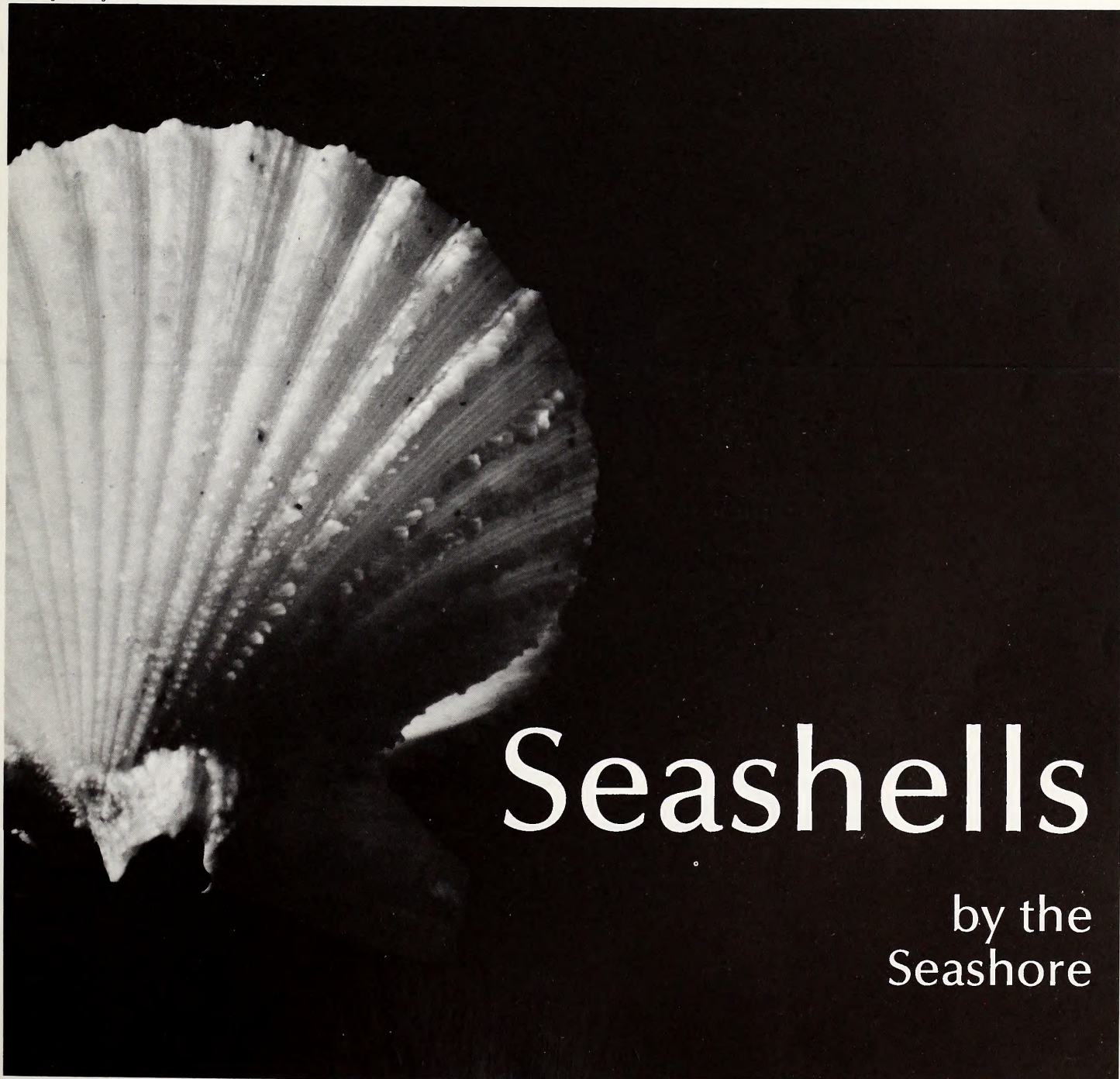
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Photo by Ken Taylor



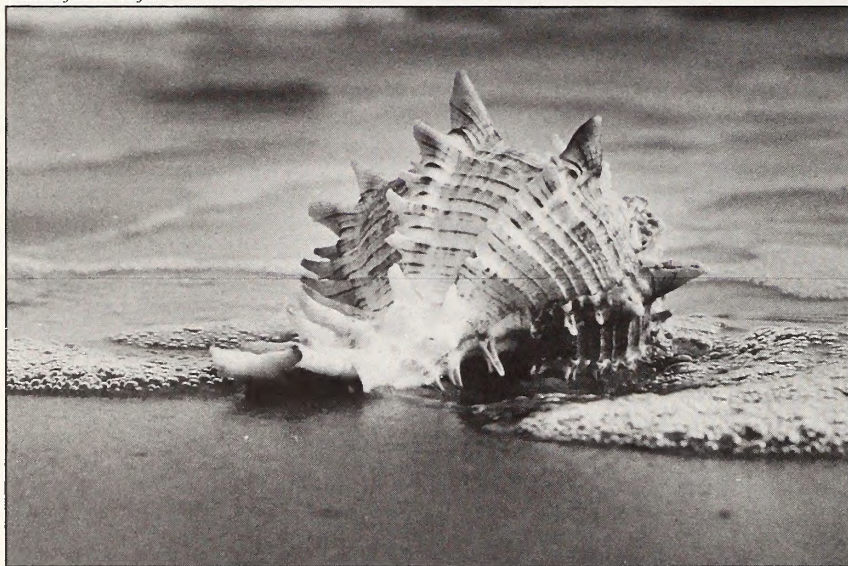
Seashells

by the
Seashore

COMBING the COAST

By Sarah Friday

Photo by Scott Taylor



Meet the Smiths of Durham. Leonard and Carolyn, their son Chris and daughter Tori.

They have a fever, and the condition is serious.

The Smiths belong to that legion of afflicted seekers who can find in a tiny piece of calcium carbonate the joy of great discovery.

They are collectors of seashells—big shells and little shells. Shells perfect and shells impaired. Shells rare and shells common. If there's a mollusk with a nature-made backpack, they want it for their collection.

And in North Carolina, they likely will find it. The coast of North Carolina is home to more than 1,000 different species of mollusks. That's one-hundredth of the catalogued number, but still more than most other states offer. And because North Carolina is centrally located on the East Coast, it offers warm-water and cold-water species.

Almost any time of the year, a variety of

seashells lie on the beach like free candy for children. All you need to become a collector is a touch of the hermit and a stretch of sandy shore.

But watch out, Carolyn Smith warns, beachcombing can be habit-forming. If the habit becomes a fever, professional help is available through the N.C. Shell Club.

The club's 250 members can tell you where to find some of the state's most common shells. Coquinas, scallops, oysters, moon snails, tulips, olives and whelks are common in the state.

Club member Walt Wenzel says one of his favorite spots is Bogue Banks. Other collectors recommend shelling anywhere on the barrier islands.

If you're looking for the state shell, the Scotch bonnet, Portsmouth Island or Hammocks Beach may be worth the trip.

The ideal time to hunt is in the winter or early spring after a severe storm. Then, you can find shells loosened from the deep and thrown onshore.

Always look at low tide when more beach is exposed and you can go out farther.

And go when the moon is new or full, collectors advise. A greater pull from the moon then increases the rise and fall of the waves. Bigger waves mean more shells onshore.

Beachcombing is fun and easy, but it doesn't always yield the best specimens.

The chances of finding a whole shell on the beach are pretty slim in North Carolina, Wenzel says. The craggy ocean floor and fierce waves can easily crush a once-perfect creation. And often the sun, wind or chemicals in the air rob shells of their natural luster.

For showcase specimens, roll up your pants, put on your flippers or drag out a net.

Wenzel dredges to find clams, oysters and snails near his home in Pine Knoll Shores. He

takes a boat out in the sound and rakes or pulls a hand seine through the shallow water.

If you'd rather somebody else do the work, ask a fisherman to search his nets. That's how Carolyn Smith found her 5-inch Northern moon snail shell, a world record.

Or try snorkeling or diving. Going underwater is the best way to find big shells in good condition. But not many collectors are willing to go to such depths in North Carolina, says Tom Van Landingham, president of the Shell Club.

"If you want to find the live shells, you've got to go in the muck," Smith says.

It's not unusual to have to crawl in the mud, wade through the tide or snake among the grasses to find that perfect shell.

In the bays and sounds, you'll find more shells in the morning or late afternoon because mollusks don't like the hot, drying sun, Smith says. Or go out at night, when species such as whelks stalk their prey.

Then seek the hidden clues.

In the mud flats, look for trails. Moon snails and olives, bury in the mud and leave their

"footprints" in the form of tiny tunnels.

Two holes in the mud mean a bivalve is buried beneath the surface. Follow the holes with your fingers to find a clam or scallop.

Whelks make a big lump in the sand. A tiny tip of the shell may stick out and give you a clue to its whereabouts.

Peer under rocks on the jetties where mollusks sometimes attach. Or comb through an oyster bed to find feeding mollusks such as the tulip.

An abundance of tiny shells like periwinkles and dove shells cling to the grasses in the marsh.

To make them even harder to find, most shells are camouflaged with algae, mud, barnacles or sponges.

So why go to all this trouble?

Live shells are more desirable from a collector's standpoint, Smith says. They're new and fresh, and are usually not nicked or broken.

Smith, as most collectors, realizes that taking live specimens raises environmental questions. The best answer she can offer is the understood

Continued on next page

Photo by Scott Taylor



TIPS FROM THE EXPERTS

You've been to the beach. Six bags of souvenirs and 14 buckets of shells give it away.

You know what to do with the souvenirs, but what about the shells?

This year, take a few extra steps to preserve your hand-picked treasures. Well-cleaned shells can be used for art, jewelry, decoration and display.

Carolyn Smith and Walt Wenzel of the N.C. Shell Club offer the following tips for making the most of your finds.

Gathering shells

- When you pick up a shell, record when, where and how you found it. Keep the piece of paper with the shell.
- Keep live mollusks in cold seawater until you get home if you want them to stay alive.
- If you plan to freeze the mollusks, put them on ice.

Cleaning them out

- If you want to eat the mollusk, boil for 2 to 5 minutes, then work the body out of the shell with a needle or ice pick.
- Or freeze the shell. When the mollusk is frozen, take it out of the ice, let it thaw, then pull out the body. The mollusk can be cooked and eaten.
- If you don't want to eat the mollusk, soak it in regular drugstore alcohol. Soaking time varies. Some shells may take 24 hours, Smith says. Then remove the mollusk.

- If the mollusk is a gastropod, like a moon snail or whelk, save the thin "trap-door" at the shell's opening and put it back. This shows the animal was taken alive and makes the shell more valuable.

- Leave the shell as is after this step if you want it to remain natural-looking.

Cleaning them up

- First try cleaning your shell with soapy water and a brush.
- Or soak it in bleach. Dilute the bleach with water, or use it full-strength if the shell is badly encrusted. Watch the shell as it soaks. It could take a few minutes or several hours to clean. Alternately soak and brush the shell if needed. Bleach should not harm the color or luster of the shell and helps remove algae, barnacles and corals.
- Pick the remaining particles off the shell with a small tool such as a dentist's pick.
- Rinse the shell.
- Dry it on a paper towel.

Preserving them

- Rub mineral oil or baby oil on the shell after it dries. This protects it from dust and dirt and helps bring out the color. Smith often rinses her shells, and puts new oil on them every year.
- Catalog the shell. Keep accurate records about it.
- Display and enjoy.

Photo by Sarah Friday



Carolyn Smith

code of ethics shell collectors share.

Don't squander shells. Take only what you need—maybe one to clean and one to show the original state. Leave egg cases and other young mollusks. And if you turn a rock, put it back. Leave the environment as you found it.

"This is what I've come to," Smith says. "To appreciate the animal that makes the shell. The challenge now is learning more about the shell

and being more conservative about my collecting.

"You never learn it all."

Sea Grant has a booklet for more information on collecting native shells. To order Sea Shells Common to North Carolina, write Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695-8605. The cost is 75 cents.

Tales of Broken Shells

By Nancy Davis

The faded chip of a seashell rolls ashore with the waves. Most beachcombers pass it by.

Not Lundie Spence. For her, that castaway shell is even more valuable than a perfect specimen for a showcase collection.

She knows it has a story to tell, and she's detective enough to uncover it.

Spence, Sea Grant's marine education specialist, examines a discarded shell the way she would a deserted house, looking for clues of the inhabitant's past.

She points to a blemish in a whelk. "It sort of looks like a scar. Maybe a blue crab tried to crack the shell when it was much smaller," she says.

Instead of stalking the state's coastal waters for live whelks, snails and clams, Spence is content to gather up their remains or just to observe the animals.

"Some people are only interested in a whole shell," Spence says. "But you can pick up pieces of shells and try to identify what that shell was—by the shape, texture, thickness and curves.

"Then you can say, 'Yeah, at one time, this spiral was part of a whelk,' or 'This purple fragment was a little clam,' or 'This orange cup-like shell is what's left of a giant horse conch,'" Spence says.

Seashells are homes for a phylum of soft-bodied animals called mollusks.

Gastropods and bivalves make up most of the mollusks. Gastropods usually have a single spiral- or cone-shaped shell. Bivalves have two shells hinged tightly together with strong muscles. Other mollusks, such as the squid and octopus, don't have external shells.

Each mollusk builds its own shell. In its larval stage, the animal secretes a material that hardens when combined with minerals from the seawater.

The genetics of each species determines what its shell will look like—whether a whelk shell curves to the left or right and whether a clam shell is smooth or has ridges. The minerals in the water affect the color of the shells.

Sometimes, if you look closely at a shell, you can figure out how the animal died. And more than likely, you'll find evidence of foul play.

For example, a clam shell with a round hole near its hinge met its demise in an encounter with a moon snail. After attaching itself to the clam, the moon snail spit out acids that corroded the shell. Then, it used its digestive enzymes to weaken the clam.

Clams often fall victim to another killer—the whelk. These slow-moving hunters inch along under the sand, their siphons sniffing out unsuspecting clams. The whelk grasps its strong foot around the clam and pries it open.

But even the whelk is not safe. A shell perforated by hundreds of tiny holes was probably the victim of an orange-colored boring sponge. The sponge attaches itself to shells and secretes an acid that eats through the shell.

Box crabs also prey on whelks, opening a hole in the shell with a can opener-like claw.

With predators like that, shells don't stand much of a chance.

If the animal isn't devoured by one of its own kind, it's likely to come up against a human.

That's why Spence urges folks to leave live shells alone. You can learn a lot about the animal's behavior just by watching.

Photo by Scott Taylor



Portrait of a Collector

By Nancy Davis

Photos by Nancy Davis



Renate Skinner with her man-eater clam (above) and her collection (below)

She waited for a year.
Timing the ebb and flow of the tides.
Watching as her treasure was washed by the waves.

Finally arranging for a special boat and seven people to help her collect the prize.

Then, when the tides were just right, the crew hoisted her discovery aboard, and Renate Skinner claimed another shell—a 400-pound man-eater clam—for her collection.

Now the cumbersome clam from a tiny island in Indonesia is the focal point on the patio of Skinner's Greenville, N.C., home. The rest of her insured collection is stored in seven teak collector cabinets.

In seashell circles, Renate Skinner is known as a rare find, a combination of scientist and

collector. She's combed the beaches of the world, and she's got a treasure of shells to show for it.

Skinner methodically pulls open each drawer and proudly shows off her finds, reel-ing off scientific names and locations of discovery. She displays her most prestigious find—a new species she discovered—in a small glass dome.

Skinner's fascination with collecting began in her native Germany. Then her search was confined to rocks, insects, wildflowers and land snails.

After World War II, Skinner took a job with an international hotel firm. When she was given her pick of locations, she chose Indonesia—"the land with the most possibility for collect-ing shells," she says.

Skinner explored the beaches of Indonesia, Thailand, Sri Lanka, Singapore, Pakistan, India and the Philippines.

All that traveling added up to a lot of shells and other artifacts. When she moved in 1976, she shipped about 4 tons of her collection to Greenville.

For her, most of that collection pales in com-parison with the 2-inch cone-shaped shell that was the first of its kind to be discovered.

"I have been on the mountain of where every shell collector wants to be. I have found a spe-cies that is new to science," Skinner says.

She was diving on a coral reef when she saw the shell in a niche between living corals and fine white sand.

Nearly seven years later, the scientific world recognized her find as a new species. Her reward was the opportunity to name the shell for her father.

But one mountain isn't enough, Skinner says. Even in landlocked Greenville, Skinner isn't ready to call it quits on collecting. For the past year, she and her husband have been planning their next vacation.

They've studied nautical maps to pinpoint when the lowest tides of the year will be in Indonesia. That's when shelling is best, she says.

Skinner will pack for the trip with shelling in mind. A large briefcase, complete with glass jars and alcohol, is her luggage. She usually collects live shells, drops them in the alcohol to preserve them, and records her find in a register.

When they arrive in Indonesia, they'll cross a mountain range by jeep, then take a boat to a tiny island. And all the way, they'll watch to see that no one follows them to their sacred shell-ing grounds.

Skinner keeps the exact location of her finds a secret. "If others found it, they would knock the corals down and destroy everything," she says.

THE BACK PAGE

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The N.C. Marine Resources Centers are changing their names. This month, they become the N.C. Aquariums on Roanoke Island, at Pine Knoll Shores and at Fort Fisher.

Mark Joyner, of the N.C. Office of Marine Affairs which administers the aquariums, says the new name more accurately reflects what visitors will see there.

Last year, over 1 million visitors peered into tank after tank of marine creatures—sea turtles, eels, lobsters, stingrays, crabs, starfish, sharks and other fish native to North Carolina waters.

And the aquariums will still offer exhibits, programs and field trips on coastal ecology, history and art.

Each aquarium will focus on a different aspect of the coast.

The Roanoke Island aquarium emphasizes the unique aquatic life of northeastern North Carolina freshwater sounds and rivers.

At the Pine Knoll Shores aquarium, learn how creatures survive in the sea through adaptation. There, an aquarium exhibit will show how sea creatures use speed, venom, camouflage, mimicry, electricity, armor, bioluminescence and more to survive.

At Fort Fisher, the emphasis is on sharks. There, several species of native sharks and their relatives, skates and rays, swim in a 20,000-gallon tank—the largest free-standing aquarium in the state.

This year, the aquariums hope to attract even more visitors as they cele-

brate their 10th anniversary and the founding of the N.C. Aquarium Society. The society is a non-profit organization to support the programs and activities at the aquariums.

The aquariums are open year-round Monday through Friday from 9 a.m. to 5 p.m. and Saturday and Sunday from 1 to 5 p.m. Admission is free.

For more information, contact the aquarium on Roanoke Island, P.O. Box 967, Manteo, N.C. 27954 (919/473-3493); the aquarium at Pine Knoll Shores, P.O. Box 580, Atlantic Beach, N.C. 28512 (919/247-4003); the aquarium at Fort Fisher, Box 130, Kure Beach, N.C. 28449 (919/458-8257); or the N.C. Office of Marine Affairs, 417 N. Blount St., Raleigh, N.C. 27601 (919/733-2290).

Your recipe calls for fish fillets, but you've just reeled in a cooler full of whole fish.

If you're used to buying your seafood from the fish market, you may not know how to clean and fillet your catch. But the process isn't difficult. All you need is a sharp knife, an inexpensive scaler, a cutting board and Sea Grant's latest brochure.

Dressing Finfish is an 8-panel brochure that describes how to fillet a dressed fish or whole fish, or how to cut butterfly fillets or steaks.

The publication was prepared by Joyce Taylor, Sea Grant's seafood education specialist at the N.C. State University Seafood Laboratory in Morehead City.

For a free copy of the brochure, write Sea Grant. Ask for UNC-SG-86-10.



Most of the time, Bob Hines works behind the scenes as he puts together the N.C. Commercial Fishing Show. But now Hines is up front as the 1986 recipient of the Southeast Sea Grant Marine Advisory Service award.

Hines, Sea Grant's MAS agent at

Bogue Banks, won the award for coordinating and promoting the Commercial Fishing Show in Morehead City.

Hines competed against agents from nine other states. He is the second MAS agent from North Carolina to win the award in four years.

Sea Grant organized the show in 1983, and continues to sponsor it with local fishing organizations and state agencies. Each year, thousands of fishermen come to see new fisheries products and hear experts discuss topics related to commercial fishing.

This year, more than 5,000 men and women attended what is now one of the region's largest fishing shows. A follow-up survey indicated it generated nearly \$800,000 in sales.



Growth and development on the coast are essential to the state's economy. But at the same time, they increase pressures on the natural resources.

Sea Grant and the N.C. Bar Association will present a coastal law conference to examine these issues Oct. 3 and 4 in Morehead City.

The program will cover the laws and regulations controlling development, especially those relating to water quality, wetlands and public trust areas.

It also will include a case study of a fictitious development project and a thorough look at the Administrative Procedure Act. The speaker for Friday's luncheon will be N.C. Attorney General Lacy Thornburg.

For more information, call Walter Clark at Sea Grant, 919/737-2454.

North Carolina has an adequate water supply and a good climate for aquaculture. But the success of a venture may depend on the site you choose.

To help potential aquaculturists choose a location for raising fish, Sea Grant has revised *Selecting an Aqua-*

Continued on next page

culture Site in North Carolina.

The two-page Blueprint provides a checklist of some items that may influence site selection.

For a free copy, write Sea Grant. Ask for UNC-SG-BP-81-4.

If you want to harvest seafood in Virginia during 1987 but you are not a resident there, you must apply for a non-resident harvester's license. Deadline for application is Sept. 30, 1986. For more information, contact Roy Insley Jr., Virginia Marine Research Resources Commission, P.O. Box 756, 2401 West Avenue, Newport News, Va. 23607, or call 804/247-2238.

The Atlantic and Southeastern Estuarine Research societies will hold a joint meeting at the St. Regis Hotel on North Topsail Island, Oct. 16 to 18.

Scientists will present their latest findings about estuarine biology, physics and chemistry and receive feedback from their peers.

For more information about the meeting, contact Sea Grant researcher Bob Christian, Biology Department, East Carolina University, Greenville, N.C. 27834. Or call 919/757-6722.



Skip Kemp is Sea Grant's new seafood marketing specialist at Bogue Banks.

Kemp comes to Sea Grant from the N.C. Division of Marine Fisheries

where he was a marine biologist. He holds a bachelor's degree in fisheries and a master's in aquaculture from Auburn University.

Kemp will advise fishermen, processors, distributors and restaurant owners on ways to improve their seafood handling practices. And he'll work with the N.C. Department of Agriculture, DMF, university personnel and private industry leaders to develop marketing strategies for North Carolina seafood.

In addition to his experience with DMF, Kemp has operated a private aquaculture firm, taught a wildlife and fisheries class at Wayne Community College, and worked with the Alabama Cooperative Extension Service.

For more information about seafood marketing, contact Kemp at the N.C. Aquarium at Pine Knoll Shores, P.O. Box 896, Atlantic Beach, N.C. 28512. Or call 919/247-4007.

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COASTWATCH

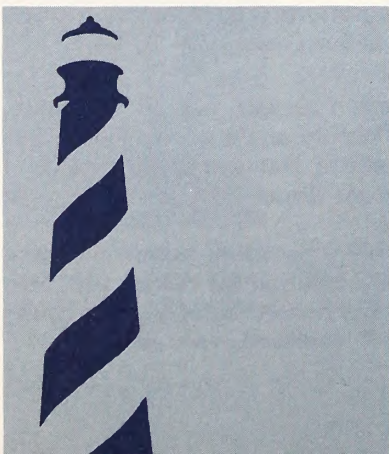
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COAST WATCH

Photo by Nancy Davis

CONFLICTS AT THE COAST

■ Developers vs. fishermen

■ Who owns the submerged lands?

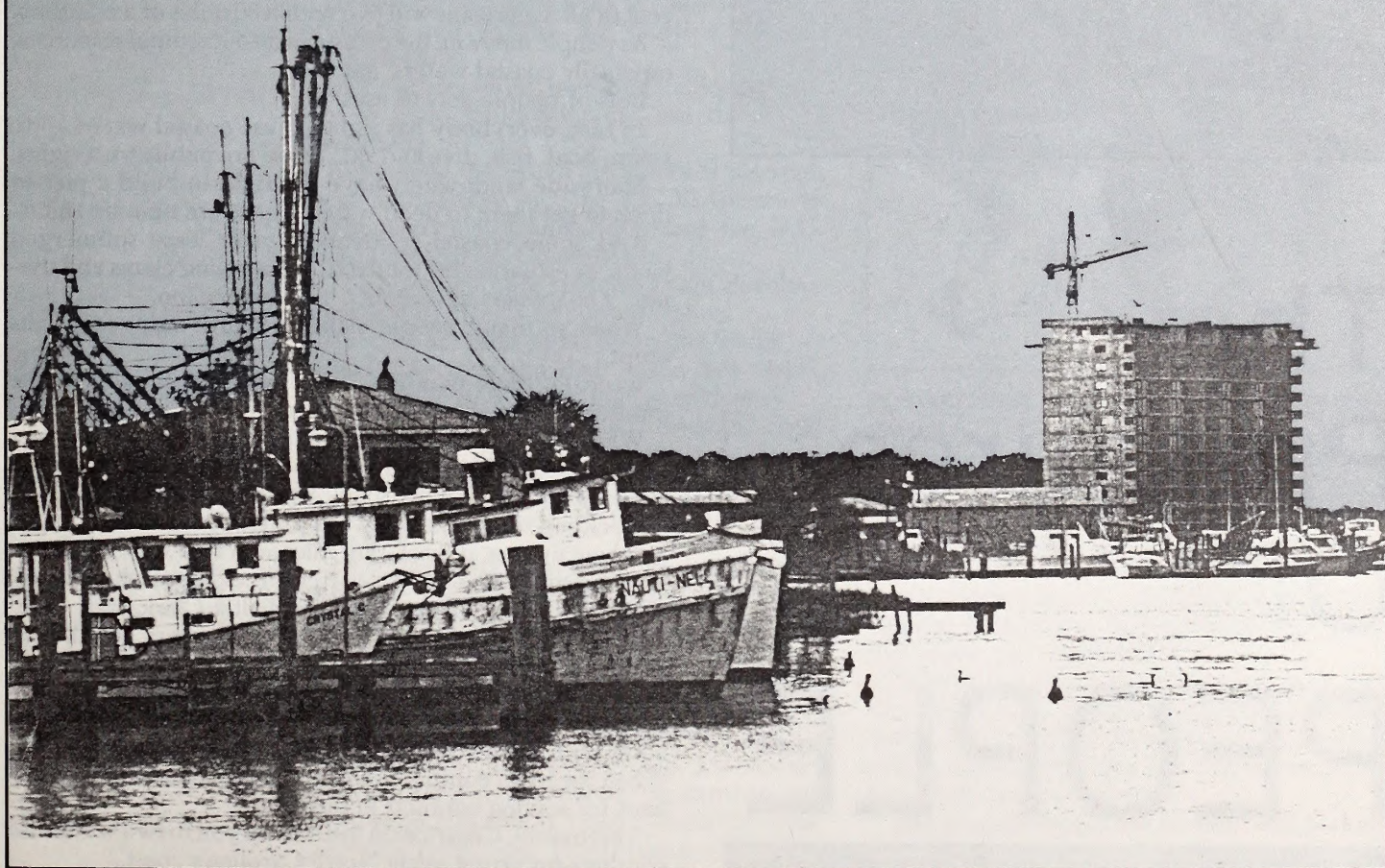


Photo by Scott Taylor



Photo by Steve Murray



Photo by Steve Murray



Atlantic Beach. Nags Head. Topsail Beach.

They used to be places you dreamed about all winter. Get-away spots to soak up sun, walk along the beach and eat plenty of fresh seafood.

Now it's likely you're a full-time resident.

Since the 1960s, thousands of people have streamed to North Carolina's coast to live and work.

By 1990 — in just four years — some people say 75 percent of all Americans will live within 50 miles of a coastline.

As people move in, the pressures on our natural resources, especially coastal waters, increase.

Lots of people, lots of uses.

In fact, everybody has rights to use coastal waters — to swim, boat, fish, dive and ski. Those are public trust rights.

Shoreside landowners have the right to build a pier or dock to get them to deep water. Those are riparian rights.

And some coastal residents own or lease submerged lands, or estuarine bottomland, for growing clams and oysters. The owners have rights. The leasers, too.

When so many people claim so many rights, conflicts erupt.

Basically these conflicts boil down to the rights of the public vs. the rights of individuals.

When should the public's right to clean water prevail over a developer's right to build a condominium? When should the public yield to those who own submerged lands?

Deciding who wins is always tough.

A new project at Sea Grant may help find some answers. With funding from the Water Resources Research Institute, Sea Grant's coastal law specialist Walter Clark, state attorney Dan McLawhorn and legal intern Barbara Namkoong have delved into the issues.

They're pinpointing the conflicts and looking at what the state is doing to resolve them. Then they're comparing these notes with ways other states have addressed the problems. When the team compiles the data, they'll have some guidelines for solving conflicts in the future.

This month, *Coastwatch* introduces you to two water-use conflicts occurring along North Carolina's coast.

The Pressures Of PEOPLE

At odds over

Coastal Water Quality

By Kathy Hart

It's the heavyweight bout of the decade for coastal North Carolina.

In one corner, harvesting 3,150,000 pounds of clams and oysters, are North Carolina's shellfishermen.

In the other corner, investing millions of dollars to build condominiums, are the state's developers.

Refereeing the match are resource management commissions such as the N.C. Environmental Management Commission and the N.C. Coastal Resources Commission.

The opponents are sparring about development and its effects on coastal waters.

At stake are their rights to use the water.

Shellfishermen say their water use rights, called public trust rights, are being denied.

Like other North Carolina residents, shellfishermen have the right to use the water. They want to harvest clams and oysters.

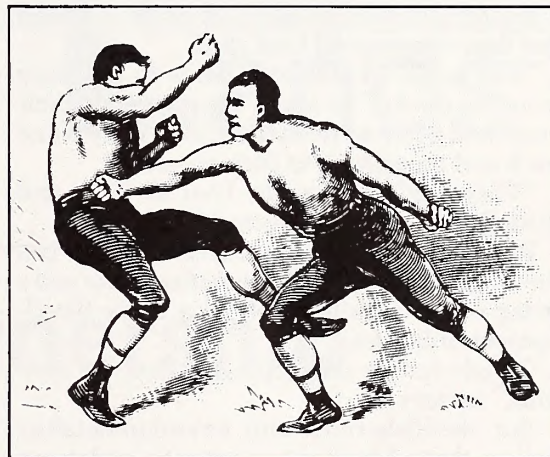
But shellfishermen say developers deny them that right.

They maintain that development leads to pollution. Pollution means closed shellfishing areas and fewer clams and oysters. It all adds up to loss of a livelihood and a loss of rights.

To assert their rights to clean waters, fishermen organize, hire lawyers and lobby legislators and regulatory commissions.

But developers have rights, too. At stake are millions of dollars in personal investments and the economic health of coastal North Carolina.

So they fight back. They organize, hire law-



yers and lobby legislators and regulatory commissions.

The first round punches are thrown over storm water runoff.

"If you build an eight-story condo on a five-acre piece of land, most of the area around the building will be covered with a parking lot," says S. Henri Johnson, an attorney for the N.C. Coastal Federation, an environmental group that represents shellfishermen.

"The rain can't permeate the parking lot, so it runs off into the sounds, carrying with it pollutants," Johnson says. "Even though parking lots and tennis courts seem innocuous, the problems they cause are severe."

But condominiums can be built and parking

Continued on next page

lots paved without degradation of water quality or loss of fishermen's rights, says William Raney, a Wilmington attorney who represents developers.

"There are construction and landscape techniques that control storm water," he says. "You can reroute the storm water or use porous paving materials for instance."

Raney's right. Developers can use methods such as holding ponds and underground pipes to funnel storm water into the ground instead of into shellfishing waters.

But not all developers have been willing to go to the extra expense of controlling storm water.

That may soon change.

A set of regulations is now pending before the N.C. Environmental Management Commission. They will require storm water control by new developments built within half a mile of shellfishing waters.

But storm water isn't the only source of pollution for coastal waters. Shellfishermen also point a finger at marinas.

Boat owners who dock at marinas tend to flush sewage into the surrounding waters.

Most developers don't argue that commercial marinas cause pollution. But private boat docks for multi-family condominiums are a different matter, they say.

Raney says that private boat docks are used less than commercial boat slips.

"The usage of the boat tends to be away from the docks," he says. "People get on their boats and go away from the docks. They come back and go upstairs to their condo."

"They don't stay on the boat all night and flush the toilet numerous times."

Raney says he sees no difference between the docks at a multi-family condominium and a string of piers trailing behind a dense development of houses.

"Single-family developments have no controls," he says.

But shellfishermen and environmentalists believe that where boats congregate, toilets are flushed.

"Studies show that marinas pollute," Johnson says. "There's no doubt about it."

Some developers have proposed a "closed head" policy for marinas. Boat owners would be required not to flush untreated waste overboard.

But Todd Miller, executive director of the Coastal Federation, says that kind of policy can't be enforced.

Johnson says, "How long have we had this anti-littering campaign? Yet people still throw out their beer cans."

Miller believes that all future marina development should be limited to areas that are already polluted.

Preston Pate is caught in the middle.

Photo by Doug Yoder



Pate, assistant director for the N.C. Division of Coastal Management, says the regulations apply equally to commercial and private marinas, and they involve a maze of state agency policies.

An N.C. Division of Shellfish Sanitation policy says that generally marinas cause pollution. Therefore, the waters around them will be closed for shellfishing.

This presents a problem if a proposed marina is sited for open shellfishing waters. An Environmental Management regulation says no new use of coastal waters can interfere with an existing use.

Since the proposed marina would close waters, preventing shellfishing, the permit would be denied whether it was commercial or private.

Developers believe the broad application of marina restrictions to private boat docks denies riparian rights.

A property owner who buys land that borders on the water has the right of access to deep water. The owner can build a pier, wharf or dock to gain that access.

Although the condominium owner's riparian rights are denied, "those rights don't give owners the right to pollute," Pate says.

Shellfishermen and developers are slugging away with countless regulations, policies and statutes to assert their rights.

Meanwhile, resource managers are trying to strike a balance between the two. With research from organizations like Sea Grant and a little compromise from the opponents, it can be done.

Resource managers hope that when the bell rings, no one loses.



Photo by Steve Murray



Submerged Lands

A matter of ownership

By Sarah Friday

More than once, Pete Rivenbark has had to cool the fires in New Hanover County.

One time a fellow thought some swimmers were trying to steal clams from his shellfish beds. Another time, homeowners around a creek wanted to claim the waterway and bottomland as their own.

But in most cases, Rivenbark is the mediator between fishermen and residents who claim to own submerged lands.

It's not always an easy job, says

Rivenbark, an assistant supervisor for the N.C. Division of Marine Fisheries.

More than 2.2 million acres of submerged land lie like fertile farmland in the waters between the Outer Banks and the mainland shore.

And much of it is involved in the biggest and longest land dispute in North Carolina.

The state has sought to ease the tension. But centuries of tradition, confusing laws and misinformed citizens blur the picture.

People who own and rent bottom-

land stand firm on one side. On the other side is the state, fighting for the public's right to keep the bottomland.

For 200 years, North Carolina easily upheld the principle of public trust, which gives individuals the right to use state waters and submerged lands.

But by the 1960s, more people were moving to the coast, placing greater demands on the water and the lands beneath it. Disputed lease and ownership claims became frequent, and the

Continued on next page

state began trying to settle the controversies.

Twenty years later, the state is still juggling public and private rights. Too many people, and too many rights are involved.

Now money is an issue.

These underwater fields are more valuable because so much of the land can be used for shellfishing. And shellfish bring fishermen a high price at the market.

In 1971, fishermen got a penny a clam, Rivenbark says. Now they get about 15 cents.

As a result of the increased value and use of submerged lands, state resource managers, commissioners and attorneys are turning to the statutes for guidance.

State law allows citizens to boat, fish, hunt, swim and carry on commerce in all navigable waters that are publicly owned, says Allen Jernigan, an attorney with the N.C. Department of Justice. Basically, the public can go anywhere in the water that a boat can go.

But state law also allows residents to lease or to own submerged lands below these public waters.

If you own bottomland in North Carolina, you have the same rights as any private property owner. You can grow and harvest shellfish, dig for minerals or leave it bare. All beds should be marked, but signs or stakes cannot obstruct navigation.

The same rules apply if you lease submerged lands. Renters cannot interfere with the public trust rights of people using the water. Likewise, swimmers and boaters cannot bother the oyster or clam beds.

It's like a parking lot, says Walter Clark, Sea Grant's coastal law specialist. Somebody may own the pavement, but anyone can use the air above it.

But leases for submerged lands in North Carolina are hard to come by these days. The state put a moratorium on leases from 1981 to 1983 to revamp the leasing system and re-evaluate the amount of public bottomland.

Fishermen also organized to stop the flow of leases. More leases would mean less public bottomland for them to fish.

Since the ban has been lifted, the N.C. Marine Fisheries Commission has approved only six leases. Nine are pending before the commission.



Photo by Doug Yoder

The commission strives for fair judgments. As with ownership claims, the courts protect private property rights, but history weighs heavily on the side of the public trust.

The state has not had the authority to sell submerged lands since the early 18th century. But for one reason or another, some land has been sold. The last piece was on Figure Eight Island in 1960.

Now thousands of residents claim to own acres of bottomland. No one knows exactly who owns what.

Under pressure, the 1965 N.C. General Assembly asked people to map and register private claims to submerged lands before 1970. Failure to file meant the claim was void.

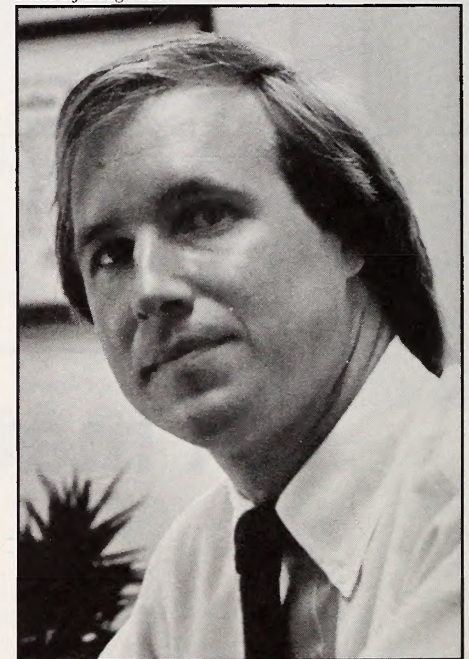
By 1970, 3,000 people said they owned more than 10,000 acres of bottomland.

But there was a catch.

Claimants had to prove direct ownership from the original deed or title.

That meant digging through records and tracing the deeds back to a grant from King Charles in 1663, for some. For others, it meant a 1920s grant from the N.C. Board of Education. And some claimed ownership by "adverse possession," saying they used an unclaimed plot for more than 21 years.

Today, the N.C. Attorney General's office is still examining the claims to see if they are valid.



Shellfishermen use leased bottomland to raise oysters (above); Walter Clark (below)

THE BACK PAGE

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Rip currents are for real. Ask Roberta Naimark of Charlotte. In August, she and her husband were riding the waves during their vacation in Duck.

A woman swimming nearby began screaming that she was caught in a current.

Roberta swam to help her.

But it was useless. "All of a sudden we were way out," says Roberta. The powerful current was whisking them out to sea.

Six others were caught — frightened and frantic to paddle their raft to shore.

But Roberta stayed calm.

The day before, she had read a Sea Grant poster in her rented cottage telling the dangers of rip currents and how to swim to safety.

"If I had not read that poster I would have thought the tide had pulled me out." But when she felt the pull and realized how fast she was moving, she knew it was more than an undertow.

The force quickened just past a sand bar. Swimming back was impossible. For about 10 minutes, the current kept pushing them out to sea.

As the two women swam to meet the raft, Roberta recalled tips in the poster.

"I remember shouting, 'They're only 30 feet wide! Swim diagonally!'" she says.

The group clung to the raft and swam across the current. Soon they were able to get close enough to the beach for rescuers to pull them in.

Later the Naimarks found out rip currents ran one after another for miles along the beach that day. One swimmer had drowned. Hurricane Charley and a full moon were playing havoc with the tides.

Roberta's level head and a few tips from the Sea Grant poster saved herself and seven others from tragedy.

A copy could save your life, too. For a copy of the free poster, write Sea Grant and ask for publication number UNC-SG-86-09.

Last year will be hard for Wayne Wescott to forget. The Sea Grant marine advisory agent spent days—and months—spreading the word about crab shedding. And it paid off. Records show last year was the best year yet for the booming soft-shell crab industry. In Dare County alone, fishermen sold more than 600,000 pounds of soft crabs. That figure topped previous sales for the whole state by more than 100,000 pounds.

Most of the crabs were shipped to markets in New York and Baltimore. But North Carolina residents got a taste of the success, too.



In August, 16 North Carolina and Puerto Rican teachers left Raleigh for a week-long trek across the Tar Heel state.

One alligator, a raft trip down the Nantahala River and 1,300 miles later, the group returned from their outdoor classroom.

Lundie Spence, Sea Grant's marine educational specialist, organized the trip to expose teachers to the state's natural water systems.

"We try to get the teachers into the systems — into the marshes, into the rivers. This experiential method of learning gives teachers a better understanding of the aquatic systems they're studying," Spence says.

Along the way, the group looked at how people used water in the past and

how it affected their lives. And they studied the ways people use, change and manage these waters today.

Spence and the junior high and high school teachers began their tour in Wilmington. They visited the N.C. Aquarium at Ft. Fisher, Bald Head Island and the Brunswick Town Historic Site.

They studied the sandhills of Carolina Beach, saw a cypress swamp and released baby loggerhead turtles.

Then they moved west to Charlotte and to Cherokee, stopping at Discovery Place, a Christmas tree farm, waterfalls and a Cowee ruby mine.

The workshop is part of an ongoing venture with the Puerto Rico Sea Grant Program. Last year, the North Carolina teachers traveled south to study the island's ecosystems. They'll get another chance next summer.



The summer of 1986 — hot, dry and sunny. Conditions seemed right. Residents along the Neuse River from Goldsboro to New Bern waited.

They expected the foul blue-green algae to pop to the surface of the sluggish Neuse and form massive green mats that would coat boats, swimmers and docks.

But the Neuse River never bloomed, and scientists wanted to know why.

Sea Grant researchers Hans Pearl, Bob Christian and Don Stanley sampled the waters of the Neuse River for some answers.

"It takes a wet spring and plenty of runoff coupled with a hot, dry summer to produce a bloom," says Hans Pearl.

But it's not the large volumes of water produced by the rains that trigger the bloom. It's what's in the runoff — millions and millions of tiny molecules of nitrogen and phosphorus. "Nutrients" they call them.

These nutrients wash off of farms, forests, parking lots and roof tops. And they're just what nuisance blue-green algae need to survive and bloom.

Continued on next page

In 1983, North Carolina had a wet spring and dry summer. The bloom-prone Neuse and Chowan rivers were coated with algae. Further north, the Potomac blossomed in view of the White House and the capitol.

After that summer, many scientists believed the blooms were related to the pace of the river. They surmised that when river flows dropped, the blue-greens had plenty of time to float to the surface and bloom.

But Paerl had some doubts about that theory.

"The river just doesn't behave that simplistically," he says.

The summers of 1985 and 1986 proved him right.

They were dry, and the Neuse River was nearly stagnant. Yet no bloom appeared.

Paerl says the missing element was a strong dose of nutrients. Nitrogen and phosphorus levels are always high in the Neuse River because of effluent from sewage treatment plants and normal runoff, but spring runoff makes the levels "super high," he says.

It takes the super high levels to nurture the blue-green algae.

Maps used to predict flood heights from storms and hurricanes do not consider erosion, says Spencer Rogers, Sea Grant's coastal engineer.

Rogers has written a report, *Coastal Erosion Issues in Flood Hazard Mapping*, that describes present deficiencies in flood maps, types of erosion and how erosion rates can be incorporated into these maps.

Without the inclusion of erosion, present flood maps distort public perception of storm risk, underestimate the potential for insurance claims and result in inadequate flood plain management regulations.

For a copy of the report, write Rogers at Box 130, Kure Beach, N.C. 28449.

A drive through any coastal town will tell you there's more to lodging these days than hotels and motels.

Bed and breakfast establishments offer visitors an opportunity to stay in

local homes with hosts who are native to the area. And it's a way for homeowners to make a profit on spare rooms.

If you're thinking of starting a bed and breakfast, Sea Grant has a publication that will help. *Opening a Bed and Breakfast* describes the investments, regulations, reservation and scheduling system, and rate structure you should consider before making your home a bed and breakfast business.

For a copy, write Sea Grant. Ask for UNC-SG-84-03. The cost is \$1.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, NC 27695-8605. Vol. 13. No. 9, October 1986. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

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COAST WATCH

Meet the Crew



November 1986: (seated left to right) Spencer Rogers, Wayne Wescott, Skip Kemp, Lundie Spence; (standing, left to right) Bob Hines, David Green, Jim Murray, Walter Clark, Jim Bahen, Joyce Taylor and Randy Rouse

IT'S ALL IN A

DAY'S WORK

You have a question about shedding blue crabs.

You try the library, friends, neighbors. But you get only bits and pieces of information, not a complete picture.

Then someone mentions Sea Grant's Marine Advisory Service. You call 473-3937, and at the end of the line is a man with all the answers.

He's Wayne Wescott — one of 12 marine advisers helping the public answer questions about the coast and its use.

These marine advisers make Sea Grant more than research.

They're extension agents who translate scientific and technical information into layman's terms. Then they make sure that information gets put to use.

That may mean helping a beach-front homeowner make his house more storm-resistant or showing a farmer how to raise striped bass hybrids.

Every day is different. No two questions are the same.

That's why we want to introduce you to our team of experts.

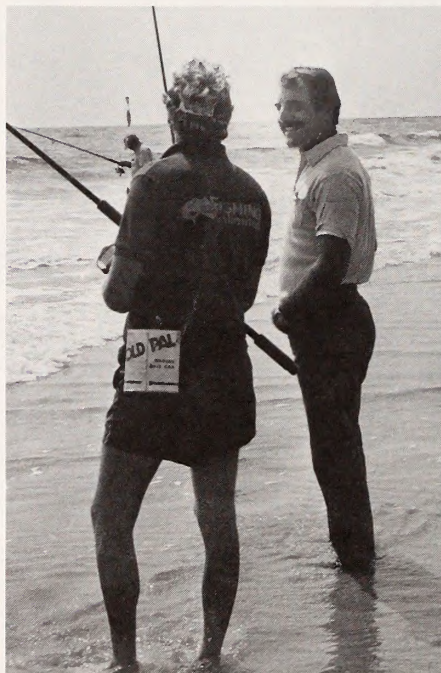
8 a.m. The Sea Grant offices in Manteo, Aurora, Pine Knoll Shores, Morehead City, Raleigh and Ft. Fisher open their doors. Rich Novak in Manteo and Jim Bahen in Wrightsville Beach have already been at work for two hours.

Novak and Bahen start the day at their respective diners, collecting local news and brainstorming ideas.

Novak, the marine recreation specialist, works closely with local businesses and organizations to promote tourism in the area.

Breakfast is business for him.

8:30 a.m. Novak heads his four-wheel drive for Hatteras. A surf fishing tournament has lured more than 50 teams to the Outer Banks for the prom-



Rich Novak (right)

ise of a catch. Novak conducts informal interviews to see how the tournament affects the economy.

He tabulates preliminary figures in his head and comes up with good results. The tournament created significant incomes for motels, restaurants, tackle shops and grocers in the area.

9 a.m. A bell jingles overhead as Jim Bahen steps through the door of a Wrightsville Beach marine supply store.

"Frog, are you ready for the tour-

nament?" the store's owner asks.

Bahen nods. His raspy voice has earned him his nickname, but his knowledge of the fisheries has gained him respect.

He's stopped by to see how many anglers are expected for the Wrightsville Beach King Mackerel Tournament that begins the next day.

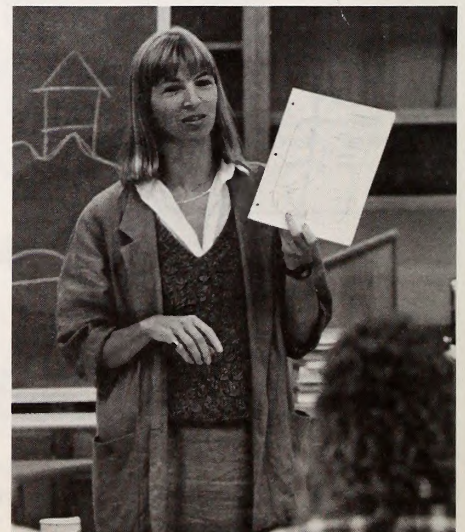


Jim Bahen

Bahen makes plans to distribute boards for measuring the kings and recording catch data. The National Marine Fisheries Service will use the information to assess fisheries stocks.

9:30 a.m. Lundie Spence prepares for class.

She packs her materials, enthusiasm and ideas and dashes off to a classroom of student teachers in Wake County.



Lundie Spence

In less than an hour, Sea Grant's exuberant marine education specialist has 26 future educators painting fish, imitating crabs and measuring simulated ocean depths.

It's all practice.

These teachers are learning marine exercises they can use later in their classrooms.

10 a.m. Skip Kemp dodges piles of fish and knots of fishermen in a Morehead City fish house as he makes his way to the office.

Kemp, a seafood marketing specialist, is here to introduce himself. Three weeks on the job and Kemp is trying to spread his name around local fish houses.

After a few words of introduction, the owner unloads some of his problems about marketing croaker.



Skip Kemp (right)

He suggests to Kemp that croaker should be divided into standardized weight classes. Now, today's medium croaker may be labeled "small" next week at the retail market, and that means a potential loss to the dealer.

Kemp takes notes and promises to speak with other fish dealers about the problem.

10:30 a.m. It's a busy morning. Joyce Taylor, Sea Grant's seafood education specialist, is besieged with requests.

One caller quizzes Taylor about the special fatty acids in most seafoods. A writer asks for recipe suggestions for cooking seafood outdoors.

The phone rings again. This time a woman needs to know how to trans-



Joyce Taylor (left)

port live eels. Another caller wants a recipe for shrimp soup.

With the requests taken care of, Taylor heads for the kitchen. There she'll work with six nutrition leaders from Carteret County's Extension Homemakers. They're trying to eliminate salt from their seafood dishes.

Today they'll test recipes that substitute herbs, spices, citrus juices and wine for salt.

Taylor samples a flounder dish. "It needs something else," she says. "It needs salt."

But she resists the temptation to reach for the salt shaker. Instead, she sprinkles garlic powder on it. Now the flounder passes her taste test.



Randy Rouse

11:30 a.m. Most of the time Randy Rouse is waist-deep in pond water, monitoring the growth of striped bass hybrids at the aquaculture lab in Aurora. But today phone calls and visitors are keeping him out of the muck.

Sea Grant's aquaculture research has ignited interest in the fledgling industry. Rouse's job is to spread the fire.

An opportunity comes when a farmer from Hyde County drops by the lab. He's interested in raising hybrids in a small pond. It sounds like a good prospect to Rouse. Rouse will visit the site later to assess the potential.

A Sea Grant scientist calls. She needs a supply of striped bass hybrids for her research on a nutritional feed for the fish. Rouse will supply her with 240 hybrid fingerlings.

Another researcher tells Rouse he's bringing a Nova Scotian businessman and prospective aquaculturist to visit the Aurora lab.



Spencer Rogers

1 p.m. After lunch, coastal engineer Spencer Rogers stops by a Carolina Beach condominium to check some beachfront erosion problems. He looks to see if the sand bags in front of the condo are holding off the ocean waves.

So far, so good. But Rogers is skeptical about the bags' holding ability.

Back in his Ft. Fisher office, Rogers prepares for the next day's meeting of the N.C. Coastal Resources Commission. He will be updating the commission on the federal flood insurance program — its strengths, limits and impacts on coastal management.

1:30 p.m. Fisheries agent Bob Hines works up a sweat as he and several local fishermen haul over 100 pounds of net into the back of his pickup.

Continued on next page



Bob Hines (left)

After a short ride to a vacant lot in Morehead City, Hines and the fishermen pull out this newfangled net and spread it on the ground.

It's a floating pound net. Commercial fishermen use the nets in New England sounds. Hines will test this one to see if it will catch schooling fish such as bluefish and spot offshore here.

Today Hines checks the net for torn spots, floats and leads. It will take days of work before the net is ready.



Walter Clark (left)

2 p.m. Walter Clark greets a packed class of N.C. State University students. Sea Grant's coastal law specialist gives a legal perspective to a marine resources class taught with cohort Lundie Spence.

Today's topic is the Law of the Sea. Clark carefully explains the Law of the Sea Treaty, territorial rights and resource exploitation.

Then he adds a touch of reality.

The scene: a mock Law of the Sea Conference. The players: seven students representing seven nations. The

goal: to determine who profits from deep-sea mining.

In the end, the students learned that negotiating is tough, that the issues are real, and that they can make a difference.

3 p.m. Helping commercial fishermen comes natural to Wayne Wescott. A coastal native, Wescott started crabbing when he was 9 years old. His father was a commercial fisherman and owned a fish house in Manteo.

You can tell Wescott likes his job when he talks to Moon Tillett, a successful fisherman from Wanchese. This afternoon, Wescott checks on some gear Tillett's been testing.

The gear is stashed away, but out in front is the fisherman's latest beef — the low prices the catch is bringing. Wescott hears him out and offers some advice.



Wayne Wescott

Murray Bridges of Colington knows the story, too. He's a crab shedder who fishes in the off-season. The flounder he's been catching aren't bringing the prices expected.

Bridges looks ahead to crab season. And Wescott can help. His assignment: check on a chemical that may spur crabs to molt and find out something about raising crabs from eggs.

3:30 p.m. David Green steps inside a warehouse-sized freezer at a Beaufort fish processing plant. The freezer is empty now, but it may eventually hold thousands of pounds of menhaden for use as bait or perhaps even as a food fish.

Menhaden, the most-caught fish in the state, is used mainly for fish meal and oil. Recently the industry has hit hard times. David Green is working to change that.



David Green (right)

"The industry has realized it can't live on meal and oil. But if it can diversify, it might be able to stay afloat," says Green.

He is working with local processors to improve onboard handling of menhaden so that a food-grade product reaches the docks.

4 p.m. In the past few hours, Marine Advisory Director Jim Murray has had eight phone calls.



Jim Murray (center)

Log them in: a researcher, three MAS directors from other states, two MAS agents, a graduate student at NCSU, and an enthusiastic entrepreneur who wants to grow snails.

From his office in Raleigh, Murray steers the MAS crew like the pilot of an oceanliner. It takes a lot of phone calls to guide 12 agents and their activities.

"A lot of what I do when I'm in the office is to coordinate things, pull things together," says Murray.

With open lines of communication, Murray keeps atop the news and events affecting the MAS.

BRINGING YOU INFORMATION

When Roberta Naimark survived a rip current, she wrote Sea Grant's communicators to thank them for her life.

You see, the day before Naimark went for that swim, she read a Sea Grant poster that advised her about what to do if she were ever caught in a rip current.

"I read the poster never thinking that the very next day I would put the information to use," says Naimark.

As Sea Grant's communicators, information is our job.

We're liaisons between coastal North Carolina and you — tourists, fishermen, scientists, businessmen. Our main goal is to give you a better understanding of the marsh where you dig for clams, the dunes you cross on your way to the beach, and even the seafood you eat.

How do we do it?

Well, you already know about *Coastwatch*. In fact, you're one of about 15,000 subscribers who receive the newsletter 10 times a year.

The three of us, editor Kathy Hart and writers Nancy Davis and Sarah Friday, focus on a single coastal topic in each issue.

First we act as reporters, conducting interviews, gathering information and taking photographs. Then we settle down in front of our computers to write the articles that keep you informed.

Our other monthly task is "Seascope," a series of four 60-second public service announcements. "Seascope" takes to the airwaves of 40 coastal stations, bringing residents and visitors up-to-date on what's up at the coast.

By blanketing the state's mails with bundles of news releases, we inform you about the latest Sea Grant research and advisory service activities.

That's not all. We take the work of our scientists and marine agents and dot the i's, cross the t's, add the commas and mark out the unneces-



(Left to right) Nancy Davis, Sarah Friday and Kathy Hart inspect *Coastwatch* as it rolls off the press

sary to make their writing more understandable.

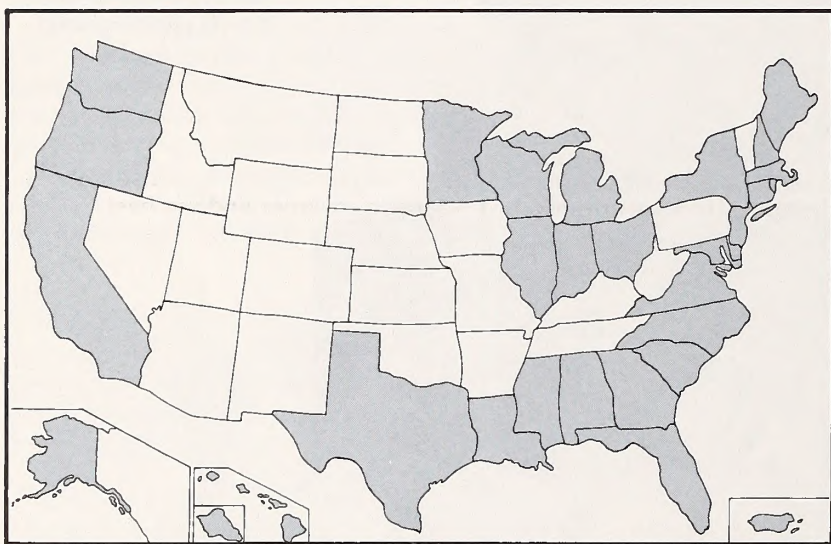
Then we work with designers and printers to package the information into pamphlets, booklets, posters or reports you can use.

And we know you're using these publications. Sea Grant receives hundreds of requests a week—over 60,000 requests a year—for everything from *Seashells Common to North Carolina* to *A Guide to Soft Shell Crabbing*.

We probably have some publications that will help you work or play in coastal North Carolina. For a publications brochure, write UNC Sea Grant, Box 8605, N.C. State University, Raleigh, N.C. 27695.

SEA GRANT

A NETWORK OF KNOWLEDGE



There's a Sea Grant program in every coastal state and Puerto Rico

UNC Sea Grant is not alone.

Twenty-nine similar programs can be found in every coastal and Great Lakes state in the United States, plus Puerto Rico.

Sea Grant is a network.

The programs work to solve the problems particular to our nation's coastal and Great Lakes regions.

Problems like declining fish stocks, contaminants in coastal waters, waste disposal and corrosion have Sea Grant scientists standing long hours over microscopes and sampling fish stocks in ice-cold waters.

Other times Sea Grant gives a research boost to budding marine industries such as the calico scallop fishery, hybrid striped bass aquaculture and the cultivation of crawfish.

Since many marine problems know no state boundaries, Sea Grant research can be shared

from state to state or region to region.

Or programs can tackle problems together.

A few examples are:

- The North Carolina, Virginia, Maryland and Delaware Sea Grant programs investigated the reasons behind declining stocks of striped bass.

- Sea Grant researchers from New York, Virginia, Rhode Island, Massachusetts and North Carolina are helping processors turn underutilized fish species into pseudo seafood products.

- The Marine Advisory Service programs in the Southeast — from North Carolina to Texas — funded a shrimp trawl film that has shown hundreds of shrimpers more about the catching ability of various nets.

And the Sea Grant network shares its marine advisory experts and their knowledge.

Fisheries agent Wayne Wescott visited Texas to show marine advisory agents and local fishermen the basics of shedding soft shell crabs.

In South Carolina, coastal engineer Spencer Rogers explained the benefits of hurricane-resistant construction techniques to the state's building code council.

As recipients of knowledge and expertise, North Carolina fishermen are wiser after instruction about longlining from Texas agent Gary Graham and about the shrimp gear from Georgia agent Jack Rivers.

All of this sharing among programs makes each Sea Grant program more knowledgeable and the network a reliable, ever-expanding source of marine information.

Call Sea Grant if you want to plug into a network of marine research and expertise.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



Shrimp trawls often sweep up more than just shrimp. Loggerhead and ridley sea turtles also fall victim to the nets.

Unfortunately, the air-breathing sea turtles frequently drown before the nets are pulled aboard the trawler and emptied.

The loss of these endangered species concerns environmentalists and the U.S. Fish and Wildlife Service. They want the National Marine Fisheries Service to take steps to stop the deaths.

NMFS could close turtle-prone areas of the Gulf and South Atlantic coasts to trawling, or they could require TEDs — trawling efficiency devices.

Sewn into the body of a shrimp trawl, the TED is a large galvanized pipe or fiberglass frame. Inside the frame are slanted deflector bars that force large objects — sea turtles, cannonball jellyfish and horseshoe crabs — out of a trap door.

Four different types of TEDs are on the market. One was developed by the National Marine Fisheries Service. The others were developed by fishermen in Texas, Louisiana and Georgia.

NMFS wanted to test the four devices to see how well they worked.

The evaluation was set for the waters off Cape Canaveral, Fla., an area with a high abundance of ridley turtles. Sea Grant agents from the Southeast, including Jim Bahen and Skip Kemp from North Carolina, helped conduct the tests aboard Georgia Sea Grant's 72-foot trawler, the *Georgia Bulldog*.

Also observing were representatives from the U.S. Fish and Wildlife Service and conservationists from organizations such as Greenpeace and the National Audubon Society.

The *Bulldog* pulled two identical 45-foot, two-seam trawls. One had a TED in it; the other didn't. Ten 45-minute tows were made with each TED design.

"All of the TED designs worked," Bahen says. "We never saw a turtle in the tailbag of a net with a TED installed."

Without the TED, the other net caught eight to nine turtles a day, he says.

Although all the TEDs excluded turtles, Bahen says the NMFS design also excluded other bycatch such as spot and croaker.

Georgia Sea Grant will test the Texas, Louisiana and Georgia TEDs later to see if the devices affect shrimp catch rates.



There was something special about Buddy Swain's 1985 coastal biology students at New Bern Senior High School. They did more than study their coastal environment.

They wrote a book about it.

The Influence of Man's Existence is a 78-page book that focuses on the impact man has had on the Trent and Neuse rivers. The book describes how the rivers were formed and how they were affected by the Indians, early settlers and modern man. And, the students offer a look into the future of the rivers.

Swain's students spent nearly a year researching, writing and editing the book. Civic organizations donated money for the book's printing.

At the end of the school year, proceeds from sales of the book were divided as scholarships among the authors. Future profits will buy supplies for the coastal biology class.

For a copy of *The Influence of Man's Existence*, write New Bern Senior

High School, in care of Coastal Biology, 2000 Clarendon Boulevard, New Bern, N.C. 28560. Enclose a check for \$5.50 made out to the New Bern Senior High School Coastal Biology Class.



No, Sea Grant's new four-color poster, *The Hardbottom Distribution Map*, doesn't pinpoint the firmest derrieres on North Carolina's beaches.

What it does identify are firm surfaces that form underwater mesas called hardbottoms.

Hardbottoms dot the continental shelf. Their edges, or scarps, are prime fishing and diving spots.

The scarps are alive with worms, mollusks, corals and sponges that attract small bait fish. The bait fish, in turn, attract larger reef fish such as snapper, grouper and sea bass.

The location of hardbottoms in Onslow Bay — an area between Cape Lookout and Cape Fear — are pinpointed on a map on one side of the poster. The map distinguishes between low-, medium-, and high-relief hardbottoms. Taller hardbottoms generally have more scarp area to attract more fish.

On the other side of the poster are five detailed paintings that realistically depict life on the ocean floor. This side of the poster makes an excellent educational tool for teachers.

The map and the information for the paintings were developed by Sea Grant researchers Stan Riggs, Scott Snyder and Albert Hine. The drawings were painted by Whiting Toler.

For a copy, write Sea Grant. Ask for UNC-SG-86-25. The cost is \$5.

The so-called crisis in insurance affects everyone—including fishermen. But what can be done about it?

That will be the topic of a national workshop on fishing vessel insurance and safety in Washington, D.C., Feb. 4 to 6.

Continued on next page

Insurance representatives, fishermen, charter boat operators, congressional staff members and safety experts will discuss ideas for possible solutions to the problem.

The workshop is sponsored by the Sea Grant College Program Network, the National Council of Fishing Vessel Safety and Insurance, and the University of Alaska Sea Grant Program.

For more information on the workshop, contact Brenda Melteff at the University of Alaska Sea Grant Program, 590 University Avenue, #102, Fairbanks, Alaska 99709-1046. Or call 907/474-7088.



Before you toss aside that amberjack, triggerfish or shark, order Sea Grant's latest publication. *Recipes with a New Catch* will supply you with 64 delicious ways of cooking nontraditional fish.

You'll learn how to prepare 18 species of saltwater fish commonly caught in South Atlantic and Gulf waters. And

you'll also find out how to clean and prepare your catch.

This 40-page recipe book was written by Jim Murray, Sea Grant's Marine Advisory Service director. Sea Grant's seafood education specialist Joyce Taylor provided many of the recipes.

Recipes with a New Catch is part of a NMFS project designed to promote the use of nontraditional fish.

Write Sea Grant for a copy of the book. Ask for UNC-SG-86-06. The cost is \$2.

From classes in vessel safety to columns in *National Fisherman* about electronics, Duncan Amos has taught fishermen about most anything you can name.

Now, as a regional fisheries specialist for Sea Grant, he's helping fishermen in the Southeast.

Amos comes from the University of Rhode Island where he was the Marine Advisory Service director and fisheries specialist.

His new position is funded by a grant from the Gulf and South Atlantic

Fisheries Development Foundation. Amos is based at the University of Georgia in Brunswick, but he'll be traveling throughout the Southeast to share his knowledge of fishing.

Sea Grant's marine advisory agents are compiling a list of possible seminar topics for Amos to present to North Carolina fishermen. If you have suggestions, contact your local agent. Call Wayne Wescott in Manteo (919/473-3937); Bob Hines or Skip Kemp at Pine Knoll Shores (919/247-4007); or Jim Bahen at Ft. Fisher (919/458-5498).

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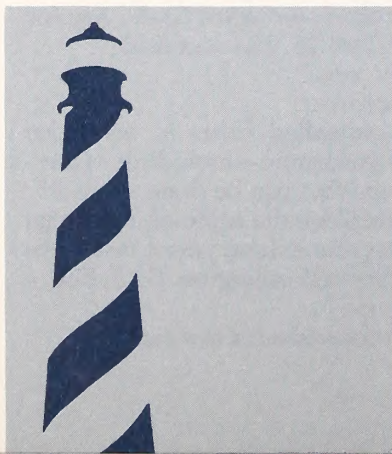
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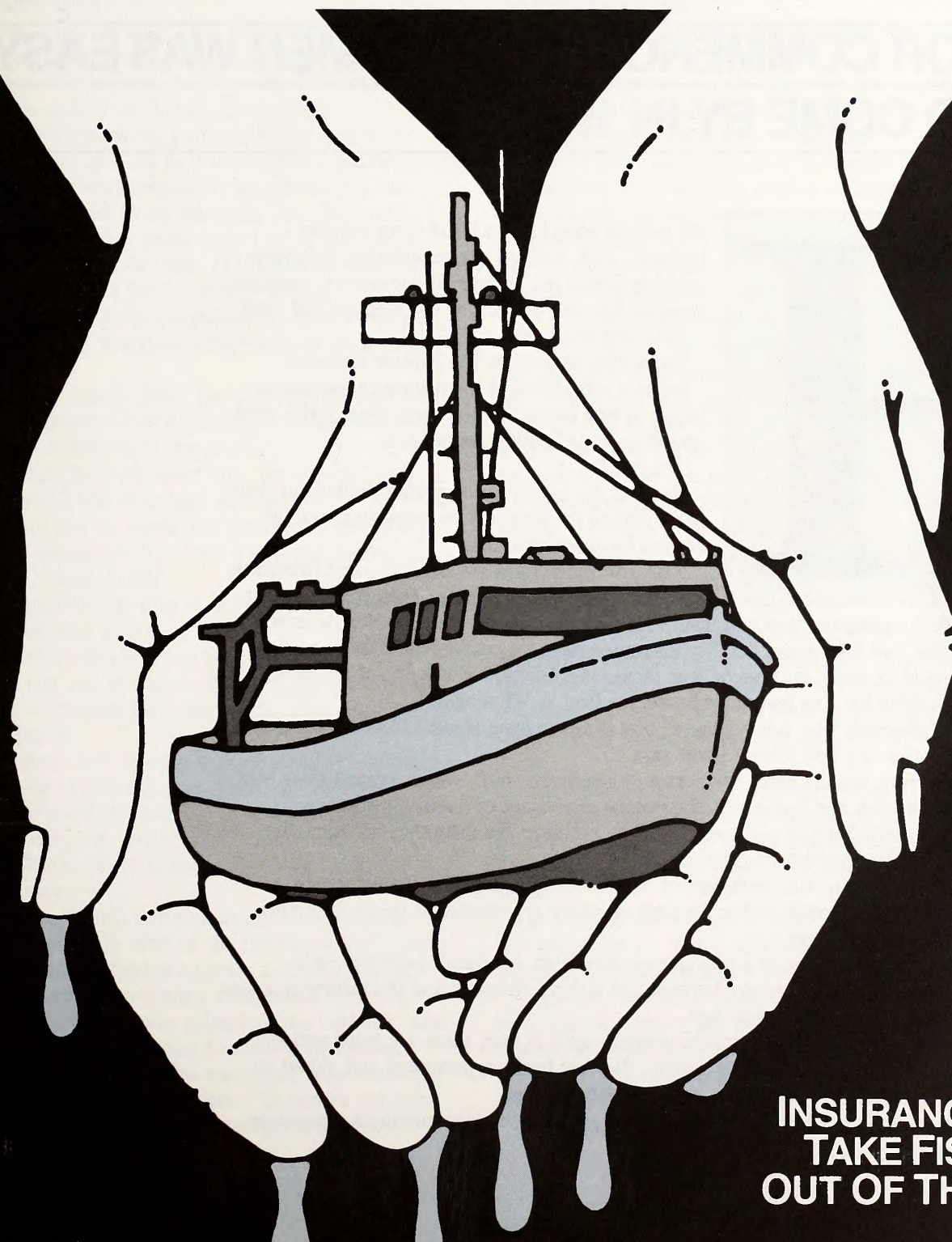


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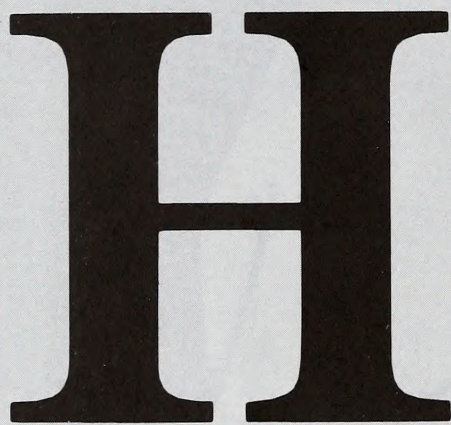


**INSURANCE COSTS
TAKE FISHERMEN
OUT OF THE WATER**

BY NANCY DAVIS

Insurance

FOR COMMERCIAL FISHERMEN WAS EASY TO COME BY IN 1980.

A large, bold, black letter 'H' is centered within a white square. The 'H' has a thick, blocky font style with a slight shadow or outline effect.

High interest rates lured a lot of firms into the business. And, with all the competition, fishermen paid low premiums. In turn, the insurance companies invested that money, earning the high interest rates.

Everyone was happy.

But within two years, the outlook reversed.

Interest rates fell and the insurance companies began to lose money. At the same time, juries were awarding large liability settlements.

The result?

Many of the insurance companies bailed out, leaving a limited marketplace for fishermen to shop around for their insurance.

Now, insurance rates are sky high, and fishermen are sinking under the burden. Even if a fisherman

can find a company that will insure him, he may not be able to cover the costs.

In the past four years, liability insurance rates for commercial fishermen have increased as much as three or four times, says Glasgow Hicks Jr., of Hanover Excess and Surplus Inc., an insurance brokerage firm in Wilmington.

"A fisherman who was paying \$5,000 is now paying about \$15,000 for a trawler in a matter of a few years," Hicks says.

Fishermen usually carry two forms of insurance—hull, which insures their boat, and Protection and Indemnity, the marine equivalent of liability insurance.

The rates fishermen pay are affected by cycles in the insurance industry, the state of the fishing industry and the courts.

Gary Buchanan, vice president of Associated Insurers, says the insurance industry has economic cycles. As rates of return on investment go up, insurance rates usually go down.

Now, the industry is in a low-interest rate, high-insurance premium cycle.

There is also a connection between the fishing economy and the insurance losses companies incur, Buchanan says.

When the fishing industry is in a slump, as it is now, there are more accident claims. Fishermen try to save money; they cut back on personnel and skimp on maintenance. As claims go up, so do insurance rates.

P&I rates have risen the fastest and are causing the most problems, insurance agents say.

Consider the Hathaway Winch case, says Duncan Amos, an area fisheries specialist with Sea Grant's Southeast Marine Advisory Service. A fisherman seriously injured by the winch aboard his boat sued the winch maker and received \$1.7 million. The defendant, Hathaway Winch, had built the winch in 1938.

"The Hathaway Winch case is symptomatic of the whole problem," says Jim Cooper, a Morehead City insurance agent.

"That's like saying a 1937 automobile doesn't have seat belts, and we're going to make a claim. That winch was built when the standards weren't the same as they are today," Cooper says.

Insurance agents say such exorbitant awards are pushing rates up. And as it becomes less profitable to write marine insurance, more companies pull out.

The U.S. Coast Guard estimates that the fatality rate of fishermen is seven times that of the average industrial worker. In 1983, 111 fishermen died in accidents and 242 fishing vessels were lost.

As fewer and fewer companies are left to insure fishermen, the decline in competition leads to even higher rates.

Insurance agents blame the trial lawyers who seek such big awards for their clients. And they point to the unpredictability of the courts.

An award for a fractured arm, for example, may be as low as \$5,000 or as high as \$500,000.

"A case may be worth \$10,000, so we give them \$20,000 because we're afraid a jury will award them \$50,000," says Cooper.

But attorneys say they're only serving the people who have been injured.

Fishermen are caught in the middle.

They may not be able to afford to pay the high cost of their insurance. But, then again, they can't afford not to pay it.

Fishermen who operate without liability insurance risk losing everything, says Amos. An injured employee could sue and "go after everything—the boat, house, cars, everything," says Amos.

But folks in North Carolina aren't as likely to sue, says Cooper.

He adds, "North Carolinians are more stable in their employment. Most of the fishermen here have grown up in the fishing business and have a good safety record. There's not a tremendous influx of people from other states going into the business. And the court system here may be more conservative."

Cooper carefully screens applicants before deciding whether or not to insure them. "If they're not experienced, we don't write it (a policy) at any price," he says.

A bill considered in the last session of Congress would have set up a system similar to workmen's compensation for disabled fishermen. The bill also placed a cap of \$500,000 on liability claims. But legislators rejected the bill. Opposition to the bill came mainly from trial lawyers and consumer groups.

That bill is being rewritten to exclude the \$500,000 limit. If passed, it will only mean that fishermen are required to carry additional safety equipment on board.

Fishermen also are looking for ways to ease the strain.

There's little they can do about the ups and downs of the insurance business, but they can band together to help reduce their premiums.

Over 30 years ago, a group of Norwegian fishermen on the West Coast set up a mutual insurance association. As a group, they invested their premiums.

Since no claim was filed against them, they applied the profit from their investments toward the next year's premiums. Eventually, the fishermen's insurance costs were lowered.

"As a club, you can control the membership. You can screen to make sure they (fishermen) operate safe vessels and have good crews," Amos says.

But he warns that such a system can't be applied with immediate results. It takes years to build up enough money so that rates can be reduced.

Self-insured groups also risk not having enough money to cover a claim. "If the money isn't sufficient to cover a claim, you have to come up with that money," says Amos. Those are risks that insurance companies usually take.

So far it seems the insurance crisis in the fishing industry is peculiar to the United States. The United Kingdom, Canada and Australia, for example, aren't experiencing the crunch. "It's not so prevalent there for people to sue and seek large settlements," says Amos.

In addition, licensing of fishermen is mandatory in many European countries. Fishermen periodically attend nautical colleges where they receive training. There is no comparable school in the United States industry.

For now, no one is satisfied with the way things are, says Cooper. "But it will literally take an act of Congress to change things," he says.

"The only answer is to put some type of predictability into it. There's got to be some moderation because all these large awards end up being paid by the public. Insurance is just a means of spreading the loss of a few among the many," says Cooper.

And fishermen are having to pay the price.

COMMERCIAL FISHERMEN

THEIR

CRISIS,

THEIR

GRIPES,

THEIR

GAMBLE

BY KATHY HART

Commercial fisherman Doug Lewis of Stacy is a gambler.

But he isn't betting at roulette, cards or craps. He's risking his livelihood—commercial fishing.

You see, Doug Lewis is uninsured.

Every time he pulls away from the dock he gambles that his boat won't catch fire or capsize or that his mate won't be injured and sue.

It's not a risk Lewis takes willingly. He simply can't afford the price of insurance for the 38-foot boat he uses to shrimp, clam and longhaul.

Hull insurance alone would cost \$3,000 to \$4,000 a year; Protection and Indemnity insurance for his mate, another \$2,000 to \$3,000.

It adds up to more than a small-boat fisherman can pay, Lewis says.

And he's not alone. Many other North Carolina fishermen are gambling too.

Insurance premiums have doubled and tripled over the past three years, adding another hefty cost to the business of commercial fishing.

Combined with rising fuel costs, increased foreign competition, limited stocks, fluctuating market prices and overcapitalization of the industry, insurance is becoming the cost that breaks the fisherman's back.

Some fishermen are hanging up their nets or going uninsured like Lewis.

Photo by J. Foster Scott



Others are writing the four- and five-digit checks that protect them, their boats and their crews, knowing that the premiums will reduce today's profits and tomorrow's investments.

All are grumbling about insurance costs, pointing accusing fingers at trial lawyers and wondering what can be done to reduce premiums.

Fishing: a risky business

Hauling in the net, pulling up the dredge or just leaving the dock can be dangerous when it comes to commercial fishing.

Sea Grant fisheries agents Wayne Wescott, Bob Hines and Jim Bahen say the danger is created by a combination of factors.

- The weather. A sudden squall, high seas or icy conditions can land even the most experienced mates in the drink or capsize a boat. Such weather increases the likelihood of drownings.

- Navigational hazards. Inlets and shifting sand bars can ground a boat, leaving it at the mercy of crashing waves. Or a rugged sea floor can cut a hole in the boat and cause it to sink.

- Balance. Shrimp boats, for instance, are top-heavy when the outriggers are up and can roll over if seas are rough. The same is true of overloaded scallop boats.

- Gear. Winches and capstan heads, used to pull in line, cable and nets, can be extremely dangerous. It is all too easy to get caught in this gear and lose a finger or arm. Overhead, swinging trawl doors or heavy nets can deal a lethal blow to a careless crew member.

But Wescott, Hines and Bahen agree that a well-trained, cautious crew and a properly maintained boat can reduce the risk of an accident.

Photo by Gene Furr



Fishermen repair winch

"I can insure all the men in my fish house for what it costs me to insure one man on a fishing boat," says William Smith of Luther Smith and Son Fish House in Atlantic.

Smith and his father own a fish house and five boats. He's paying \$2,900 per crew member for P&I insurance, and his boats carry five- and six-man crews.

It's a cost Smith's business must absorb. "There's no way to pass the expense along to the middle man or the consumer," he says.

Moon Tillett of Moon Tillett Fish Co. in Wanchese agrees.

"Everything we make goes back into the business," he says. "There's nothing left at the end these days."

To reduce the possibility of lawsuits, Tillett and Smith are more careful about the men they hire to work on their boats.

"I don't think about hiring people who have an injury history or who have sued before," Smith says.

And to reduce the risk of injury to his mate, Lewis keeps his boat in good condition and

handles dangerous equipment himself.

"I only allow my mate to cull," he says.

Despite precautions, fishermen get only slight reductions in premiums for good safety records, Smith says.

"All of my men carry survival suits, and I have a life raft aboard every boat," he says. "But I get very little credit for those things."

Clinton Willis, president of the Carteret County Waterman's Association, is even more negative: "Insurance companies don't want to write insurance for vessels no matter how safe they are or what we do to make them safer."

Fishermen also complain that insurers take a national approach to the fishing industry. They say there is no breakdown for regional differences and types of fishing.

They claim that North Carolina crew members tend to be more knowledgeable about fishing, less accident prone and less likely to sue than their counterparts in other regions.

"North Carolina has a good record," Willis

Continued on next page

Photo by Sarah Friday



Doug Lewis

says. "Why should North Carolina fishermen be persecuted for what's happening elsewhere?"

Lewis says, "I haven't worked with anyone who I thought would sue me. People here are more interested in working than being paid for sitting at home."

Since many crew members in traditional fishing communities such as Harkers Island, Gloucester or Salter Path are family or neighbors, the likelihood of a lawsuit resulting from an injury may be reduced, says Sea Grant agent Skip Kemp of Morehead City.

But you can't count on that, says Tillett. He knows because of a recent settlement.

Whether or not North Carolina watermen are a better risk, premiums are high, and fishermen are wondering what can be done to force them downward.

Talk in some communities centers on banding together to become self-insured as some of their Northern and Pacific neighbors have done.

Vessel safety and maintenance requirements for such groups would have to be stringent and the initial premiums would show no reduction. But for a group with a few or no claims, the benefits could be lower premiums later.

Although Tar Heel fishermen are willing to undergo yearly inspections and provide better safety training for their crews, they balk at the group concept of self-insurance.

"Fishermen here are hard to get together," Tillett says of his Wanchese peers.

Lewis and Willis say the same of Carteret County watermen. But both believe the time may have come for fishermen to surrender some of their individualism.

And Willis believes it may be time for the state to step in and exert some control.

"The state has authority over the licensed vessels using its waters," he says. "Then the state should regulate the insurance these vessels must pay."

Other fishermen are appealing to their congressmen for changes in legislation that would limit their liability.

For now, possible remedies to the insurance crisis are all talk. But that may soon change.

The Sea Grant College Program network and the National Council of Fishing Vessel Safety and Insurance are sponsoring a national workshop on insurance and safety in Washington, D.C., February 4-6.

The workshop will provide a forum for fishermen to discuss problems and possible solutions to the crisis with insurance industry experts, congressional staff members, NCFVSI representatives and Sea Grant marine advisory agents.

NCFVSI has also recently provided \$20,000 to study North Carolina fishermen's insurance problems and needs.

Photo by J. Foster Scott



"Why should North Carolina fishermen be persecuted for what's happening elsewhere?"

With the aid of the N.C. Fisheries Association, the Walden Risk Management Group of Chattanooga, Tenn., will survey fishermen, says Joe McClees, association executive director.

The association is asking fishermen, seafood dealers or anyone who has anything to do with boats to call 919/249-2080. If fishermen will leave their name and number, a Walden representative will call them back and complete the survey.

McClees says the survey should provide some insights into the insurance problem and should point the association toward some possible solutions.

But until then Lewis sums it up like this: "Fishermen today are no better off than when Jesus chose Peter. There are no more benefits."

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



You've got your own ideas about the fish you catch. For instance, you think that pigfish are too small for eating, that ladyfish are too bony to bother with, and ocean catfish aren't as good as their freshwater cousins.

Well, some Sea Grant researchers are out to change your mind.

Sea Grant Marine Advisory Service Director Jim Murray and East Carolina University anthropologists Jeff Johnson and David Griffith have developed a series of six colorful brochures featuring underutilized species from Gulf and South Atlantic waters.

You've already read about the work they've done with species such as amberjack, triggerfish and shark. But now the researchers have added to the list of fish they are promoting.

This series of brochures features pigfish, mullet, black drum, ocean catfish, ladyfish and bluefish.

Each brochure contains information on catching, cleaning and preparing the fish. And, several recipes are included for each species.

The brochures are part of a National Marine Fisheries Service study in which the researchers examined why anglers prefer some species of fish over others.

For a free copy of the brochures, write Sea Grant. Please specify which brochures you want: black drum, UNC-SG-86-19; bluefish, UNC-SG-86-20; lady fish, UNC-SG-86-21; mullet, UNC-SG-86-22; pigfish, UNC-SG-86-23; and ocean catfish, UNC-SG-86-24.

A limited number of accompanying posters are available for public display. For more information, contact Sea Grant.



The 1986 tax reform program may not change a fisherman's net worth, but it could affect his wallet.

Sales tax, income averaging, depreciation—they're all covered in the new program. And they'll make a difference to North Carolina's commercial fishermen next April.

So decisions on how to act on these changes should be made now.

One of the changes is that state and local sales taxes will not be deductible in federal returns in 1987. For fishermen, this means that they cannot deduct sales tax from any items purchased after Dec. 31, 1986 for business use.

Or if a fisherman wants to sell his boat, the new tax law does not give special tax status for capital gains. All gains from the sale of the boat will be treated as ordinary income. This provision could have a major impact. Many fishermen used capital gains to protect profits on boat sales so they could retire or buy a bigger boat.

A third possible change states that only 80 percent of business meal costs will be deductible. This means higher costs in the long-run for fishermen because groceries are a large expense.

Check with your area Sea Grant agent for other alterations in the tax law (Manteo - 919/473-3937, Pine Knoll Shores - 919/247-4007 and Fort Fisher - 919/458-5498). Then work out the best plan with an accountant or a tax preparer.

You have an opportunity to help shape a management study. Sea Grant is cosponsoring a conference to encourage public participation in a study of the Albemarle and Pamlico estuaries.

The conference begins at 8:30 a.m. Feb. 14 at the Beaufort County Com-

munity College in Washington, N.C.

The study, funded through the Environmental Protection Agency, will draw on the expertise of a host of state agencies. Its purpose is to expand our knowledge of the Albemarle and Pamlico estuaries and to improve our management of them.

The day-long conference is the public's first opportunity to learn about the study and make suggestions about it.

Other conference sponsors include the N.C. Coastal Federation, the Pamlico-Tar River Foundation and the Regional Development Institute at East Carolina University.

For more information, contact Todd Miller, executive director of the N.C. Coastal Federation, 919/393-8185.



The average angler: Who is he? Where does he live? Why does he fish? How much money does he spend?

Four years ago, a team of Sea Grant researchers posed these questions to the men and women who fished North Carolina's northern and central sounds and rivers.

Now their answers can be found in a 180-page Sea Grant report: *Recreational Fishing in the Sounds of North Carolina: A Socioeconomic Analysis*, by Jeffrey Johnson, Peter Fricke, Marcus Hepburn, James Sabella, William Still and Carl Hayes.

The study reveals the socioeconomic characteristics of the marine recreational fishing population in the area. And, more importantly, it shows the economic demand for and impact of recreational fishing in eastern North Carolina.

For a copy of the report, write Sea Grant. Ask for UNC-SG-86-12. The cost is \$5.50.

For some people, recreational fishing is more than pleasure. It's a business.

A new Sea Grant report, *Marine Re-*
Continued on next page

creational Fishing, Marine Manufacturers and Marinas in North Carolina: An Economic Characterization, by Jeff Johnson and Rick Perdue, examines the impact of recreational fishing on two of the state's important marine industries—marine manufacturers and marinas.

The report provides economic and descriptive information on both industries. It reveals information about employment, size, salaries, revenues and expenses.

For a copy, write UNC Sea Grant. Ask for UNC-SG-86-3. The cost is \$2.

A good show demands a repeat performance.

That's why Sea Grant and the Carteret County Waterman's Association are hosting the seventh annual N. C. Commercial Fishing Show March 14 and 15.

Last year, more than 4,500 people attended the boat and gear show at the

Crystal Coast Civic Center in Morehead City.

Even more are expected this year for the show that will feature boats, engines, electronics, fishing gear and accessory equipment. And workshops and seminars on various fisheries topics will be offered.

The 1987 Commercial Fishing Show will be held at the civic center off of U.S. 70 in Morehead City.

Dealers and manufacturers interested in securing a booth at the show may call Sea Grant agent Bob Hines at 919/247-4007.

Last year Sea Grant published a brochure/poster that listed the schedule for the 1986 saltwater tournament season in North Carolina. By popular demand, Sea Grant plans to publish this list again.

But we need some help.

If you are a tournament director or sponsor, we would like for you to send

us some information about your tournament. We need to know the full name of the tournament; the date it will be held; a name, address and contact person for the sponsoring organization; and any other pertinent information (such as a new eligible species category).

Please send this information to Jim Bahen, Sea Grant Marine Advisory Service, P.O. Box 130, Kure Beach, N.C. 28449. Or call 919/458-5498.

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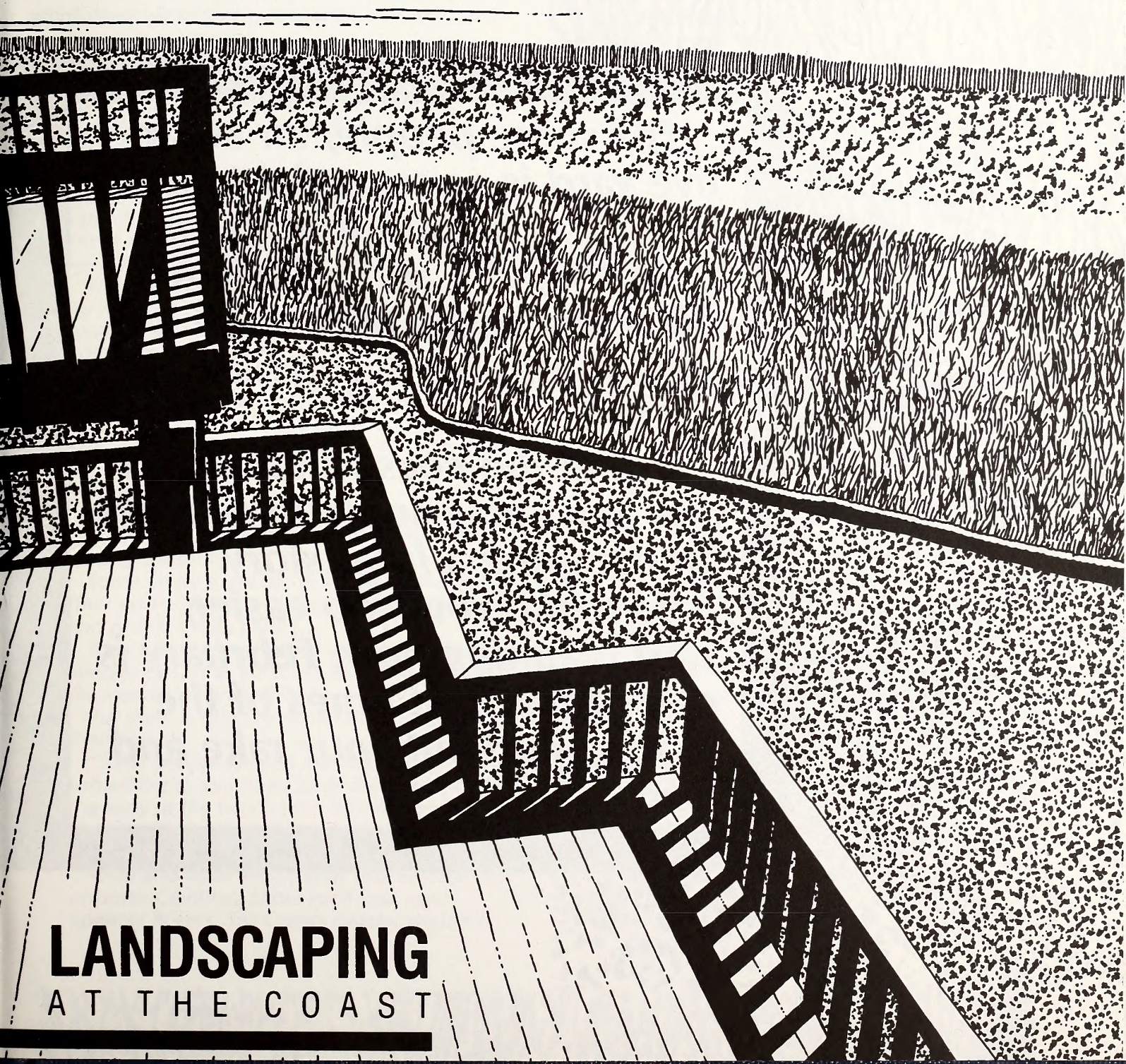
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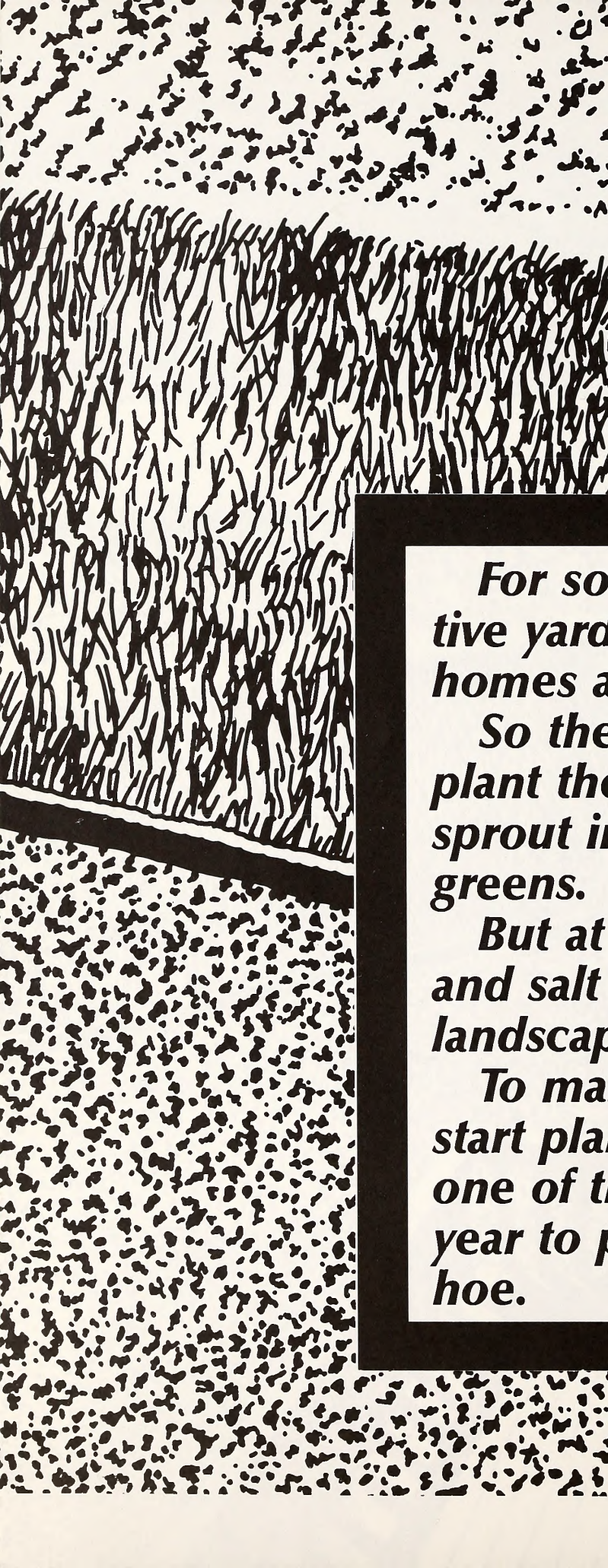
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COAST WATCH



LANDSCAPING
AT THE COAST



LANDSCAPING

By Sarah Friday

For some people, an attractive yard is as essential to their homes as furniture or carpet.

So they dig and mulch and plant the seeds they hope will sprout into fertile, stabilizing greens.

But at the coast, heat, wind and salt spray sometimes make landscaping a lawn story.

To make your job easier, start planning now. February is one of the best times of the year to pull out your rake and hoe.



When shoppers come to Bill Strope's store in Beaufort, they usually look for three things—style, function and simplicity.

When they leave, they're not wearing the latest fashions. Instead they're toting bundles of beach grass and bags of fertilizer.

With Strope's help, they're dressing up their yards.

He's a coastal landscaper who also runs a garden center and an irrigation business. And business is growing.

The idea of coastal landscaping is taking root in the minds of the state's property owners. They're planting everything from North Carolina-grown yaupons to the exotic purple fountain grass.

And they do it for a variety of reasons.

Like Gail Gentry of Morehead City—she'd take yard-of-the-month every time. And Clawson Hicks of Pine Knoll Shores—he just wants to keep his lawn from washing away.

There's no doubt Gentry puts aesthetics first for her yard. She sometimes spends 30 hours a week to get that "manicured look" around her Williamsburg-style home.

"You have to make your yard fit your house," Gentry says. And it has to look good.

So Gentry plants boxwoods and mondograss in front of her house, azaleas on the side, and felt-like grass all around.

And it's worth it.

She gets compliments even in the winter.

Still, the idea of beauty and the beach differs among residents.

Some prefer to let native species thrive in their yards. They see beauty in swaying sea oats and prickly yucca plants.

With a little clipping and pruning, native species can be as attractive as and more hardy than exotic ornamentals.

But there is often more to coastal vegetation than beauty.

"Some people are just looking to find something to stop their sand dune from blowing away or the beach from blowing across their yard," says Ben Hill, a landscape consultant from Manteo.

Wind and water whisk away two to three feet of North Carolina's shore each year, says Spencer Rogers, Sea Grant's coastal engineer.

Clawson Hicks knows the story. He lives near the water and owns other coastal real estate.

"I want to stabilize the soil so it won't wash away," he says. So he plants plenty of grass and shrubs.

For stabilization, Rogers suggests first installing a barrier such as a sand fence or a discarded Christmas tree to trap the sand. Then plant American beach grass and, later, sea oats. Once the vegetation becomes established, it will thrive on its own, he says.

Erosion also presents a problem on the sound side of the barrier islands.

Marsh grasses work in certain sheltered areas. Other erosion control methods, like bulkheads, are often necessary and have fewer adverse effects than on the oceanfront.

Although landscaping needs vary, most people have the same general goals in mind. They want a plan that requires little maintenance, is attractive, functional and cost-effective.

But landscaping doesn't come cheap.

"People are willing to spend more money on landscaping now," says Hill. "They want things to look right."

"If you're going to have enough money to buy a house down here, you're usually going to have \$3,000 or \$4,000 to landscape your yard," says Franklin Walker, business manager at Lloyd's of Landscape Ltd. in Wrightsville Beach.

That's about the average cost per yard, he says. The fee includes lawn design, installation and maintenance.

Other landscapers' estimates span from \$500 to tens of thousands of dollars.

Sprinkler or irrigation systems often run up the bill. A complete irrigation system can cost up to \$3,000.

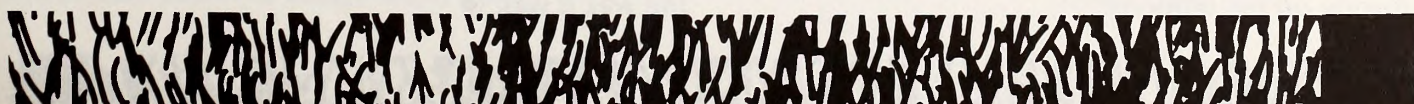
Landscapers install them most frequently in the more southeastern counties where the growing season is 245 to 300 days a year.

Barry Batchelor, owner of Azalea Coast Landscaping in Wilmington, says irrigation and landscaping just about go hand-in-hand now.

"In fact," he says, "I can't think of a home we've done in the last three or four months that we haven't put irrigation in."

To cut costs, many residents rely on their own green thumbs.

Continued



Gail Gentry implements her own designs. And she saves by doing the yard work herself.

In addition, nurseries and garden centers stock a generous supply of plants and advice. And N.C. Agricultural Extension Service agents and district soil conservationists offer free help.

Consult such experts on the right plants to use in your area. Plants that survive Wilmington's sweltering summers may not live through Manteo's biting winter winds.

"The best rule of thumb is, 'Don't move a native plant either 50 miles north or south of where you find it,'" says Karl Graetz, a renown coastal horticulturist.

Along the northeast coast, a colder climate and harsh northeast winds weed out all but the hardiest plants. That's why only 10 or 15 percent

of Ben Hill's clients choose plants for their beauty.

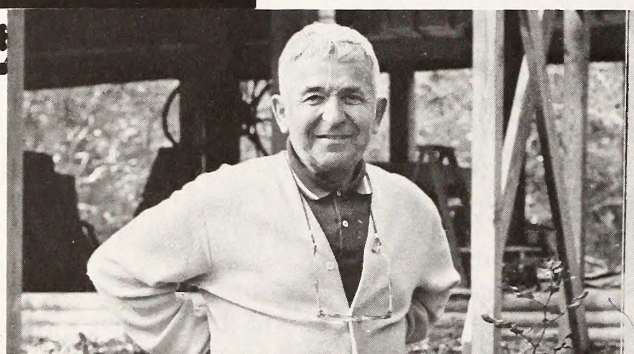
As you move down the coast, warmer weather permits a wider variety of growth.

Strope uses more ornamentals than he used to, and he imports plants from California, Texas, Georgia, Louisiana and Florida.

"We're able to now start using the more elaborate landscape materials," he says.

But Strope admits only some of the fancier plants work. Making it through the seasons is the test. ●

(Sea Grant has two booklets with more tips on stabilization. Write us for Planting Marsh Grasses for Erosion Control, UNC-SG-81-09; or Building and Stabilizing Coastal Dunes with Vegetation, UNC-SG-82-05.)



If it weren't for the cold weather and a few inconveniences, John Alpar would probably live outside.

You see, Alpar loves plants.

Every inch of his yard in Emerald Isle is tilled for one green thing or another. And a good part of his house is a nursery.

He comes by his avocation honestly. It's also his vocation.

A horticulturist and landscape architect, Alpar treats his yard as he would a good friend. He nurtures it, gives it his time and strives to make the most of the land that encircles his house.

"I really enjoy it very much," says Alpar. "I like things to grow. I like living things, color."

After 17 years in North Carolina, he's learned what can grow at the coast.

"Many, many plants will grow just like anywhere else. You have to work. You have to be there and look after it."

Pamper the plants while they are small and let them get established, he advises. "Then nature will take it from there."

As far as landscaping goes, Alpar leaves most of the work to nature.

When he started planning a few years ago, the first thing he did was see what was already growing on his property.

"Nature's always correct," Alpar says.

He was lucky. His property was closer to the sound than the ocean and allowed for more growth.

So Alpar left the tall pines and holly trees, and found native plants that would complement them. Exotic plants, he says, would give him a lot of headaches.

He has no grass. He doesn't like to mow.

So, for ground cover, Alpar uses juniper, partridge berry, English lavender and lots of pine straw.

And he plants perennials like chrysanthemums and day lilies for color and "years of enjoyment."

He also finds pleasure in his small garden, a patch of herbs and roses—his favorite.

A purist of sorts, Alpar germinates his own seeds and uses no chemicals.

You get a better plant that way, and it's less expensive, he says.

"People spend \$4 to \$5 for a single plant. At the same time, I get a package of seeds and get hundreds of them," he adds, grinning.

Alpar's meticulous care continues as the seeds grow. Every morning he waters his yard and checks for insects. In the evenings, he looks over his plants again, pruning or fertilizing them when needed.

When spring comes, Alpar is glad he hasn't cut corners.

Despite the dry soil, the heat and the salty air, his yard blooms with life.

His secret?

"I can see the beauty in the land like God and nature put it there. I want to keep it going the way it was." ●

Photo by Scott Taylor

A GREEN THUMB'S GUIDE TO



Cultivating the Coast

BY NANCY DAVIS

It's a never-ending battle for survival.

Day after day, wind thrashes the blades of sea oats and beach grass. Salt spray settles onto the leaves of the live oak. And, in the summer, temperatures on the sand's surface rocket above 100 degrees.

For plants, the coast is not an easy place to live.

For landscapers, it will take more than a green thumb to turn this harsh environment into a vegetated vacation spot. It will require planning, perseverance and a short lesson on coastal horticulture.

Karl Graetz, a horticulturist and author of *Seacoast Plants of the Carolinas*, says homeowners can't expect to change North Caroli-



Karl Graetz (above); sea oats on a dune

na's barrier islands into a tropical paradise.

It's not likely, for example, that you'll see swaying palm trees rising above a lush, green forest of trees and shrubs.

If it's palm trees you want, he says, "you might as well buy the tree trunk and put plastic leaves up there."

With a little research and a copy of *Seacoast Plants*, Graetz says you can succeed at a do-it-yourself landscape project. And this month is one of the best times of the year to plant things such as beach grass and small shrubs.

(For a copy of *Seacoast Plants*, write Sea Grant. Ask for UNC-SG-73-06. The cost is \$2.)

If you're still hesitant, your district soil con-

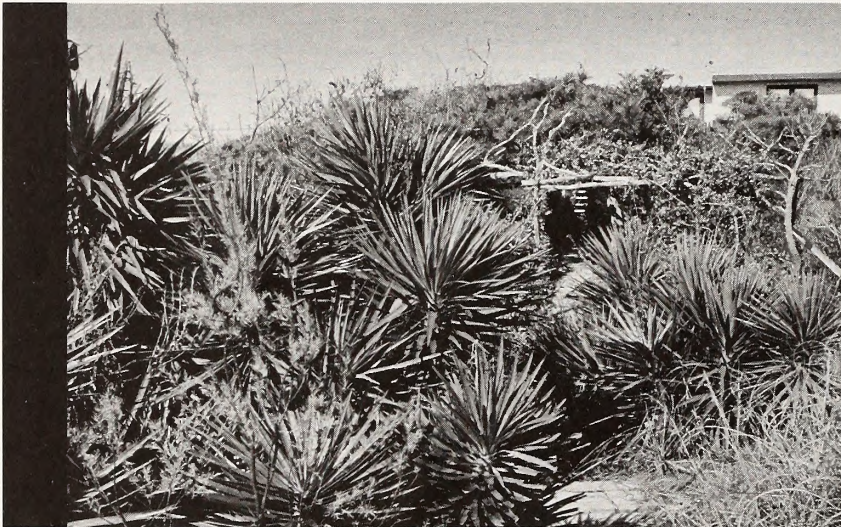
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servationist of the U.S. Soil Conservation Service can provide advice. Local nurserymen also can help with the selection of species and their planting.

Begin by making some mental sketches of your lot. Think of coastal property as a series of zones, Graetz says.

The grass or pioneer zone is closest to the ocean and has the most direct exposure to the elements. Only the most tolerant beach grasses and low-lying plants can survive here.

Photo by Scott Taylor



Even in winter, thick foliage lines the walkway to Graetz's beach house

The middle, or "scrub zone," begins behind the protection of the first dunes. Here you'll find plants such as yaupon holly, wax myrtle and live oak.

Most beachfront lots never advance beyond the scrub zone, Graetz says.

Farthest from the shore is the forest zone, containing pine and hardwood trees, shrubs and vines.

Since the zones often overlap, your yard may be able to support a variety of plants.

After you determine the characteristics of your lot, check with a local nursery to find out what plants are available and their recommended planting seasons.

If you're constructing a new home, ask your builder to leave as much of the natural vegetation as possible. This will make your landscaping job easier.

And Graetz says you'll have better success if you stick with native plants.

Those plants have adapted to the coastal environment and they're salt hardy, Graetz says. "Besides, the native plants are really gorgeous, and most people don't recognize that."

If you have beachfront property, begin your landscaping project on the dunes. This is the most important area because its stabilization is essential to the protection of your property.

Graetz recommends a combination of American beach grass, sea oats and bitter panicum interspersed with a low ground cover such as

lippia, trailing wildbean or yuccas.

Plant beach grass in the fall and winter. Then, in the summer, add bitter panicum and sea oats.

You can buy the grasses and the proper fertilizer from a nursery. (It is illegal in North Carolina to dig sea oats.)

Behind the first row of dunes, a wider variety of plants can survive. "When these plants get their heads down below that salt wind, you can grow much more," Graetz says.

Choose from plants such as wax myrtle, live oak, red cedar, red bay, yaupon and American holly. Another of Graetz's favorites is the Carolina cherry laurel tree.

These plants can be used for landscaping around your cottage. But be sure not to plant too closely to your building.

"Have an idea of what it will look like when it's grown," Graetz says. "Most people put a 2-foot-high plant 2 feet away from the building. But it'll be 6 feet wide when it's full grown."

Next, you're ready to tackle the lawn grasses.

The best choice is centipede. It requires the least care and management and takes only three years to get a good sod. Bring in 4 to 5 inches of topsoil to mix in with the sand.

Bermuda grass is another possibility, but it requires a lot more management.

For salt hardness and resistance to wave action, choose the native bitter panicum. In a recent northeaster, this grass withstood the waves better than any other. It must be purchased from a nursery or transplanted from a natural area; it can't be grown from seed.

For show, Graetz lines his driveway with seacoast bluestem. In some parts of the coast, bluestem makes up about 70 percent of the native grasses behind the frontal dune.

Bluestem grows about 1½ feet tall, has a chalky blue color and sprouts feathery seed heads.

"A low fall sun slanting across stands of this grass might remind you of a frosted fairyland," Graetz says.

If you want your yard to have that natural look, Graetz suggests planting seaside goldenrod. You know it as a weed that causes hay-fever. But Graetz says that's a fallacy. The pollen of the goldenrod is so heavy that it falls to the ground instead of floating through the air.

The goldenrod will add a bright green color to your yard, and in October, its blooms add a showy yellow color.

Keep in mind these are only a few suggestions, Graetz says. And even though native plants have a better chance at survival, some exotic species from as far away as Japan have done very well on the North Carolina coast.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



Sea Grant researchers believe the hybrid striped bass is about to make a big splash in the seafood market.

And to help the hybrid on its way, we've organized a team of Sea Grant experts to study various aspects of its marketing.

- Jim Easley, marine economics specialist, will conduct a study to determine the costs of producing hybrids.

- Marketing specialist Skip Kemp will survey consumers and seafood dealers to find out what market names are used for the hybrid and which is favored by consumers.

- Joyce Taylor, seafood education specialist, will make sure consumers know how to prepare the hybrid; she'll develop recipes for the fish.

- Seafood extension specialist David Green will examine possible products to be made from hybrids, and he'll test the hybrid's freezer life.

- Associate Sea Grant Director Ron Hodson was chosen recently as chairman of a committee to form a national hybrid striped bass association. The proposed association will promote the commercial culture of the hybrid and develop markets for the fish.

Tune in to public television for a better picture of Sea Grant in North Carolina. Feb. 23 and March 1, Sea Grant Director B.J. Copeland will appear on "North Carolina People."

He'll join host William C. Friday for a lively look at North Carolina's coast. He'll explain how Sea Grant research and extension programs are helping us

understand our marine resources.

The 30-minute program airs on North Carolina's public TV stations at 7:30 p.m., Monday, Feb. 23, and again at 6 p.m., Sunday, March 1.



March 14 and 15, it's likely more North Carolina fishermen will be inside than out on the water. That's when Sea Grant and the Carteret County Waterman's Association will host the seventh annual N.C. Commercial Fishing Show.

New boats, gear and equipment will be on display at the Crystal Coast Civic Center in Morehead City. And workshops and seminars on various fisheries topics will be offered.

In addition, the U.S. Coast Guard will provide information on vessel and fishing safety this year. There also will be demonstrations using survival suits.

The show's hours are 9 a.m. to 6 p.m. Saturday and Sunday. The civic center is on U.S. 70 in Morehead City.

For more information, call Bob Hines at 919/247-4007.

In conjunction with the 1987 N.C. Commercial Fishing Show, Sea Grant will sponsor a series of workshops for commercial fishermen.

Duncan Amos, a nationally known gear specialist, will conduct a seminar at the show at 2 p.m. Saturday, March 14 on corrosion control and prevention. At 10 a.m. Sunday, Amos will lead a session on electrical systems for vessels up to 100 feet in length.

Amos also will conduct workshops in other areas of the coast. On Thursday, March 12 at the Brunswick County Complex in Bolivia, the topic will be color chromoscopes. Amos will repeat that session in Manteo on Monday, March 16 at 7:30 p.m. at the N.C. Aquarium on Roanoke Island.

For more information, contact the marine advisory agent in your area. Wayne Wescott, Manteo (919/473-3937); Bob Hines, Bogue Banks (919/247-4007); or Jim Bahen, Ft. Fisher (919/458-5498).

UNC Sea Grant is soliciting proposals for the 1988-1989 funding period. If you're a researcher and would like to submit a proposal, call the Sea Grant office in Raleigh or consult the "Call for Proposals" memorandum available at the research office of your university.

All proposals must be submitted by April 24.



Fishermen who have been around the tournament circuit know the scene: a pile of billfish, tuna, shark or king mackerel, stacked on the dock like cordwood, baking in the hot summer sun. It's enough to offend any concerned fisherman.

To help preserve fisheries stocks and reduce the waste of a valuable resource, Sea Grant has published *Reducing Kill in Fishing Tournaments*. The 10-page guide is geared toward members of tournament committees and fishing clubs, and it presents some alternative ways to conduct a tournament.

For a free copy of *Reducing Kill in Fishing Tournaments*, write Sea Grant. Ask for UNC-SG-86-27.

UNC Sea Grant has received approval for its 1987 budget. The program was awarded \$1,189,000 in federal funds to complete the third year of a three-year program proposal. The federal funds are matched by \$650,000 in state funds.



Three Sea Grant researchers have received funds for a project to develop marine recreational fishing in Puerto Rico and the U.S. Virgin Islands.

Marine Advisory Service Director Jim Murray and East Carolina University anthropologists Jeff Johnson and David Griffith will examine the demand

Continued on next page

for recreational fishing in the area.

They'll poll people who promote and use the fishery resources in Puerto Rico and the U.S. Virgin Islands. And they'll try to determine if recreational fishing is a potential product the islands could market.

The project, which is sponsored by the National Marine Fisheries Service Southeast Regional Office, will be coordinated with another study. A Puerto Rico Sea Grant researcher will study the ability of the islands to support an increased recreational fishing industry.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, NC 27695-8605. Vol. 14, No. 2, February 1987. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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☐ City/County government

☐ Marine recreation

☐ Commercial fishing

☐ Mass media

☐ Educator

☐ Seafood processing/marketing

☐ Farming

☐ State government

☐ Homemaker

☐ University professor/researcher

☐ Lawyer

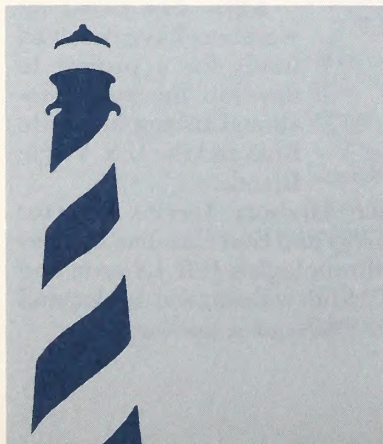
☐ Other _____

Coastal property owner ☐yes ☐no Boat owner ☐yes ☐no

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COAST WATCH



EROSION—THE NEVER-ENDING BATTLE

WIND AND WAVES TAKE A BITE OUT OF BEACHES

The Bible warns people not to build a house upon the sand.

The seventh chapter of *Matthew* reads: "The rains came down, the floods rose, the winds blew and beat upon that house and it collapsed. And the wreck of it was complete."

But people ignore this advice.

Lured by the beauty of the sea and the beach, people perch their houses and hotels near the ocean's sandy edge.

But on the first of January 1987 the rains did come, the ocean did rise and the winds did blow.

These forces beat upon the houses of coastal North Carolina. And one Long Beach residence collapsed; it was a complete wreck.

The Jan. 1 northeaster was a harsh reminder of this



Spencer Rogers

biblical parable. At Long, Kure, Carolina and Topsail beaches, the northeaster's lashing waves licked up vast quantities of beach sand, undermined the foundations of some houses and tore away the stairways, dune walks, porches and ground-floor walls of other ocean-front dwellings.

It was erosion at its worst.

Winter northeasters are notorious for hurling their erosive forces at the North Carolina coast. In fact, in recent years these storms have been more destructive than hurricanes, says Sea Grant researcher John Fisher, a civil engineer at N.C. State University.

As part of the Sea Grant research project, Fisher and another NCSU civil engineer, Margery Overton, are studying the effects of winter storms on dunes.

When the study is complete, the team will be able to plug information about a dune's size and a storm's intensity into a computer model and estimate the amount of dune erosion expected from a storm.

Fisher says dune erosion is based on several factors—the height of the tide, the magnitude of the waves, the size of the dune and the amount of dune vegetation.

The New Year's Day northeaster arrived on an astronomical high tide. The sun, moon and earth were aligned so that their gravitational effects combined to produce higher high tides and lower low tides.

Combine these high tides with a northeaster's strong onshore winds, which often clock in at 50 mph or more, and you get an eroding combination.

"Big winds make big waves, and big waves destroy dunes," Fisher says.

Erosion occurs as nature tries to strike a balance between water elevation, wave action and sand size, says Spencer Rogers, Sea Grant's coastal engineer.

by Kathy Hart

"You change one factor, such as the water elevation, and it's all out of equilibrium," he says. "The beach will then make adjustments to reach a balance."

During storms, waves suck beach and dune sand offshore and store it. After the storm, some of that sand will be restored to the beach. But other sand particles will be caught in longshore currents and carried parallel to the shoreline.

The result is usually a net loss of sand for the beach, Fisher says.

Besides their winds and waves, northeasters also possess an enduring quality. Rogers says these storms can park themselves off the North Carolina coast for days, battering the shoreline on high tide after high tide.

And exactly where these storms do the most damage depends on the orientation of the shoreline and the position of the storm.

The famous Ash Wednesday northeaster of the 1960s terrorized beach communities from the Outer Banks northward. But the two big storms of this northeaster season have wreaked havoc along the southeastern shore, particularly at Topsail and Long beaches.

Now many Topsail and Long beach homes, stripped of their dune protection, stand vulnerable to the next storm. To protect the homes, these communities have already begun beach nourishment and dune rebuilding projects (see story, page 5).

But these projects may only buy property owners a little extra time. These beaches will continue to erode, and storms such as northeasters and hurricanes often show where the erosion problems are most chronic, Rogers says.

Coastal resource managers estimate that the average



Photos by Scott Taylor

erosion rate for Tar Heel beaches is 2 to 3 feet each year.

Rogers says some areas are eroding at a faster rate; others, at a slower pace. And a few miles of the state's shoreline are actually building up, or accreting.

Scientists predict that the coast will continue to erode as long as sea level increases. Now sea level is rising at a rate of 6 to 12 inches each century.

But many scientists, including Fisher, expect that rate to increase.

Fisher says a combination of factors, including an increase in carbon dioxide levels and industrialization, will raise air and sea temperatures, melt portions of the polar ice caps and raise ocean levels.

"The rise in sea level is going to eventually magnify our erosion problems," Fisher says.

WHEN WINTER WINDS BLOW

by Kathy Hart

Meteorologists classify them as classic winter storms. Landlubbers know them as snow producers. But coastal folks call them as they feel them—"blows."

Whatever the name, northeasters are known along the East Coast as notorious winter troublemakers.

Along the southern coast, these low-pressure systems are laden with battering winds and rain. But as they sidle up the Eastern Seaboard, the rain often turns to snow—so much snow that occasionally it buries the nation's capital and halts air traffic from the Northeast.



Wayne Jones, a National Weather Service specialist, says there are three types of northeasters.

The first type moves from the Gulf of Mexico to the South Atlantic, typically close to Cape Hatteras. There, the storm draws strength from the warm waters of the Gulf Stream before hurling northward in a counter-clockwise swirl.

These systems are called Hatteras lows, and in 1984 a team of scientists assembled in North Carolina to study the formation of the storms. The \$7 million research program was funded by the National Science Foundation and the Office of Naval Research.

Another type of northeaster moves from the Great Lakes or the Ohio Valley to the southeastern coast where it intensifies and then tracks up the Atlantic Seaboard.

The third type of northeaster derives from a rare alignment of weather systems, Jones says. A strong high-pressure system in the Northwest combines with low pressure in the Southeast to make for strong northeast winds and higher high tides.

The early December northeaster that mauled Topsail Beach was of the third type, Jones says. But the New Year's Day storm was a typical Hatteras low.

Although the Jan. 1 storm caused a lot of coastal damage, Jones says the late January northeaster that dropped 8 to 20 inches of snow on western North Carolina was a more powerful storm.

The difference for coastal residents came in the tide levels. The Jan. 1 northeaster struck on an astronomical high tide; the latter storm did not.

Jones says the winter storm season, which typically lasts from fall to early spring, varies in its activeness from year to year. This year, an active southern jet stream has meant storm after storm has bombarded the East Coast.

EROSION REMEDIES

COASTAL COMMUNITIES STRUGGLE TO SAVE THEIR BEACHES

by Sarah Friday

Tony Caudle would just as soon forget last New Year's Eve.

While most of his friends partied up a storm, the Topsail Beach town manager prepared to fight one.

The rain, wind and waves from one of the worst northeasters of the decade threatened to wash his beach away.

And it did.

Topsail lost up to 60 feet of beach in some areas, and miles of dunes were flattened.

It was one more blow in the battle with erosion.

North Carolina's 320 miles of coastline face the problem daily.

In peril are millions of dollars of beachfront property and the state's coastal economy. Experts disagree on what can be done; some even ask if it's worth it.

"No matter what we do, it's not a permanent solution," Caudle says. The ocean continues to devour the shoreline like a giant with an insatiable appetite.

Three years ago, at the recommendation of Sea Grant's coastal engineer and Topsail's mayor, the town built dunes on the lowest end of the island to block the monster's bite.

The fortress worked during the first big northeaster in December. And just one section gave way Jan. 1.

Still, \$3 million worth of damages trouble the town.

But Topsail was just one of several beach communities that were hard hit by the storm. Damage estimates climbed to \$30 million for the North Carolina coast.

"Long-term erosion is a coastal problem we're going to have to deal with," says Spencer Rogers, Sea Grant's coastal engineer. "Erosion is not going to go away. It's not likely to be this bad every year, but it may be worse."



Tony Caudle

On the average, North Carolina loses 2 to 3 feet of beach each year.

If this trend continues, the N.C. Division of Coastal Management estimates 800 buildings will be destroyed or seriously damaged in 10 years. In 50 or 60 years, the number shoots to 4,900.

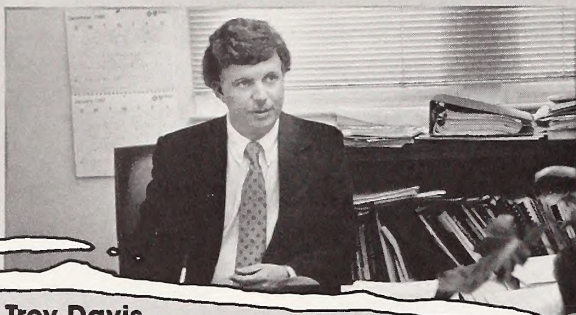
"It's something we're worried about constantly," Caudle says. "Before the storms, we had a moderate amount of beach we think the community enjoyed."

"Spencer (Rogers) says it will come back, that our beach will gradually reproduce itself," he says. "But I'm afraid if it doesn't come back we'll lose a lot of tourism dollars."

Tourism generates more than \$800 million in revenues in the 10 major tourist counties at the coast. New Hanover County alone collected \$178 million last year.

Fishing adds another \$200 million. And property owners contribute their own significant sums to the state's economy.

Continued



Troy Davis

The erosion threat keeps federal, state and local managers searching for ways to save North Carolina's beaches.

The state made one of its first moves in 1974 when it passed the Coastal Area Management Act.

Since 1979, new houses built near the beach must meet stringent setback standards. Regulations require homeowners to build behind a line 30 times the annual erosion rate. For larger buildings, it's 60 times the rate.

In addition, oceanfront property owners can no longer put up bulkheads, seawalls and revetments. Although these hardened structures sometimes help the immediate property, they often rob sand from the beaches on either side.

It's already happened in New Jersey. Little to no beach remains in towns such as Cape May and Asbury Park that erected bulkheads.

To help prevent such disasters, North Carolina aims its regulations at preserving beaches, not beach houses, says Dave Owens, director of the N.C. Division of Coastal Management.

The ultimate goal is "not to do anything in the short-term that will affect the long-term public use of the beach," he adds.

"In North Carolina, we have a tradition of high recreational use of our beaches," says Walter Clark, Sea Grant's coastal law specialist. "To allow this tradition to continue is to keep it in the public's hands."

The public owns the beach below the high-tide line in North Carolina. And in general, the dry sand beach above the line belongs to adjoining private property owners.

As the beach erodes, the high-tide line moves in and owners lose some of their private property, Clark says. In places with severe erosion, houses actually may be trespassing on the public's beach.

"The beach is always going to be there," Owens says. But the problem is the beach moves and development doesn't.

So the conflict between migration of ownership and public right continues. And it intensifies with increased development at the coast.

Many beachfront property owners think bulkheads and seawalls should be allowed. Or that federal flood insurance should help them pay to have their houses moved.

Not everyone agrees.

But, Owens says, "We still have some choices—the opportunity to protect our beaches and to use them in a reasonable fashion."

Spencer Rogers outlines the options in North Carolina.

Relocation

Historically, the most common effective erosion method for an individual homeowner has been to pick up a house and move it. The N.C. Coastal Resources Commission is urging local, state and federal management commissions to get involved in this.

Many residents have already moved. The cost varies, but averages \$15,000 (lot not included).

Beach Restoration or Renourishment

Rogers considers beach restoration the best long-term public structural solution. Huge volumes of sand are deposited in precise locations to build up the beach or restore it to its original state.

Restoration works well in low-erosion areas away from tidal inlets.

But it's expensive. And in high-erosion areas, the sand has to be replaced too often, Rogers says.

And most of the time, renourishment is "the treatment of the disease and not the cure," he adds.

Topsail Beach and Long Beach want to implement such projects, but the cost is prohibitive at \$1 million a mile. Most of the money towns have now for erosion control comes from a 3.5 percent N.C. accommodations tax.

Sand From Navigation Dredging

Sand often must be cleared from waterways in high-erosion areas like inlets. As sand is dredged, it can be pumped to eroded areas at little or no cost to the community.

Dredging projects are generally smaller and use less sand than renourishment projects.

But in some areas, it is not cost-effective. And often dredged sand is not coarse enough to build up the beach.

Temporary Erosion-Control Structures/Sandbags

When the foundation of a house is less than 20 feet away from the erosion scarp, residents can use sandbags. The 5-by-10, two-ton bags offer temporary help. But they often fail in severe storms. When bags are heavy and numerous, they can cause peripheral erosion.

Bulldozing

Most coastal towns use bulldozers to move sand to erosion-prone areas. Although bulldozing is relatively inexpensive, Rogers believes it is not effective.

"It just moves around the same sand that is already on the beach," he says.

Artificial Seaweed Or Similar Sandtraps

In theory, artificial seaweed acts as an underwater sand fence that builds sandbars. But tests in North Carolina, other states and Europe consistently have shown that it is ineffective in controlling wave-induced shoreline erosion.

Most of these options require a permit from the N.C. Division of Coastal Management. For more information, contact the division.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



March is the beginning of crab-shedding season in North Carolina. It's a time for blue crabs to come out of their shells and for seafood lovers to savor the taste of these soft-bodied delicacies.

It's also a time when crabbers are busiest.

If you're thinking of starting a crab-shedding operation, you'll want to order *A Guide to Soft-Shell Crabbing*. Written by Wayne Wescott, Sea Grant's marine advisory agent in Mantoloking, the 32-page book is designed for the layman who is considering crab shedding. It includes sections on blue crab biology, identifying and handling "peelers," harvesting methods, shedding methods and more.

In addition to diagrams and illustrations, color photos depict the various stages of peelers. These photos enable the novice to recognize the subtle signs of a blue crab preparing to molt.

For a copy of *A Guide to Soft-Shell Crabbing*, write Sea Grant. Ask for UNC-SG-84-01. The cost is \$3.

Study a new marine environment without ever opening a book. Join Lundie Spence, Sea Grant's marine education specialist, for a teacher workshop in the Caribbean seaport of Belize.

July 4 to 11, participants can take a first-hand look at coral reefs, mangrove systems, grass flats and rain forests. And they can paddle a canoe, snorkel or swim in tropical waters.

The workshop, which is cospon-

sored by Sea Grant, is open to teachers from any state. The trip costs \$950 from Miami. For an application, write Spence at Sea Grant.



North Carolina's Albemarle / Pamlico Sound will be the national estuary of the month in April. In honor of the occasion, a group of politicians, state resource managers and scientists will speak to congressional staff members, national resource managers and the public about the Albemarle/Pamlico's importance.

The seminar will be held in the Herbert C. Hoover Building in Washington, D.C., April 9.

U.S. Rep. Walter B. Jones, chairman of the Committee on Merchant Marine and Fisheries; Secretary Thomas Rhodes of the N.C. Department of Natural Resources and Community Development; and Sea Grant Director B.J. Copeland will be among the featured speakers.

Others include William Hogarth, director of the N.C. Division of Marine Fisheries; John Costlow, chairman of the N.C. Marine Fisheries Commission; Michael Orbach, chairman of the N.C. Marine Science Council; Bud Cross of the National Marine Fisheries Service's Beaufort Laboratory; and Doug Rader, project director of the Albemarle/Pamlico Project.

Each month the Estuarine Program Office of the National Oceanic and Atmospheric Administration designates an estuary of the month.

For more information about the April seminar, contact Bud Cross at the National Marine Fisheries Service in Beaufort at 919/728-3595.

Seafood is a newcomer to the grocer's meat counter. And it presents some new and different marketing challenges for the retailer.

Initially, many consumers find seafood a little confusing because there are more species of fish and shellfish than other meats.

But a seafood counter attendant can use several marketing tools to alleviate the confusion.

One of those is a method Skip Kemp, Sea Grant's seafood marketing specialist, calls "seafood focus." Seafood focus is a continuous in-store promotion that features a precooked dish made from a particular species of fish or shellfish.

In Sea Grant's latest Blueprint, Kemp describes how to use the seafood focus to attract customers and increase sales. The Blueprint is designed primarily for grocers and seafood market retailers.

For a free copy, write Sea Grant. Ask for UNC-SG-BP-87-1.



Hard clam fishermen may have hit hard times in North Carolina. The recent increase in landings of this savory shellfish has triggered concern of potential overfishing. Fishery managers predict the problem will get worse unless a proper management policy is implemented.

To help decision makers understand the implications, three economists have compiled the report, *An Economic Analysis of a Potential Overfishing Problem: The N.C. Hard Clam Fishery*.

Yu-Mong Hsiao of Campbell University and Thomas Johnson and J.E. Easley Jr. of N.C. State University used 20 years of data to find that hard clams have not been overfished yet. But they did find that more fishermen and fishing resources are being used than are needed to generate maximum economic returns in the fishery.

For a copy of the report, write Sea Grant and ask for UNC-SG-86-11. The cost is \$3.50.

It takes more than a textbook for students to learn about the ocean.

That's why the Year of the Ocean Foundation recently funded a new resource guide for marine science teachers.

Continued on next page

Ocean Prospects: a high school teacher's guide to ocean-related topics lists curriculum guides, activities, books, films, periodicals and public and private organizations available to educators. Many of the materials are free.

Ocean Prospects also includes up-to-date information on the science, industry, recreation, careers, management and future of the ocean's resources.

For a copy of the 12-page booklet, send your name, address and \$1 to Sea Grant.

Doing a job well has its rewards.

Aug. 4 to 8, 20 high school students with winning aquatic science projects will travel to Rhode Island for the 1987 World of Water Awards.

World of Water recognizes students who have won state or regional science fairs exhibiting aquatic projects. Winners of the competition will be invited with their teachers to present their projects at the National Marine Educators

Association Conference at the University of Rhode Island at Kingston.

The group also will participate in activities related to modern marine science and learn about career opportunities.

Deadline for World of Water entries is May 1. For more information, write Vicki Clark, Mathematics and Science Center, 2401 Hartman Street, Richmond, Va. 23223.



Sea Grant Director B.J. Copeland and coastal law specialist Walter Clark will present papers at Coastal Zone '87, an international symposium on coastal and ocean management.

The symposium attracts about 1,500 decision-makers, professionals and citizens, representing over 30 countries.

Copeland will present a keynote address on the environmental problems of Albemarle and Pamlico

sounds. Clark will discuss water use zoning and its value in resolving coastal water use conflicts.

Coastal Zone '87 will be held May 26 to 29 in Seattle, Wash. The symposium is sponsored by the American Shore and Beach Preservation Association, the Coastal Zone Foundation, the National Oceanic and Atmospheric Administration and others.

For more information, contact Delores Clark, NOAA External Affairs, Rockville, Md. 20852. Or call 301/443-8031.

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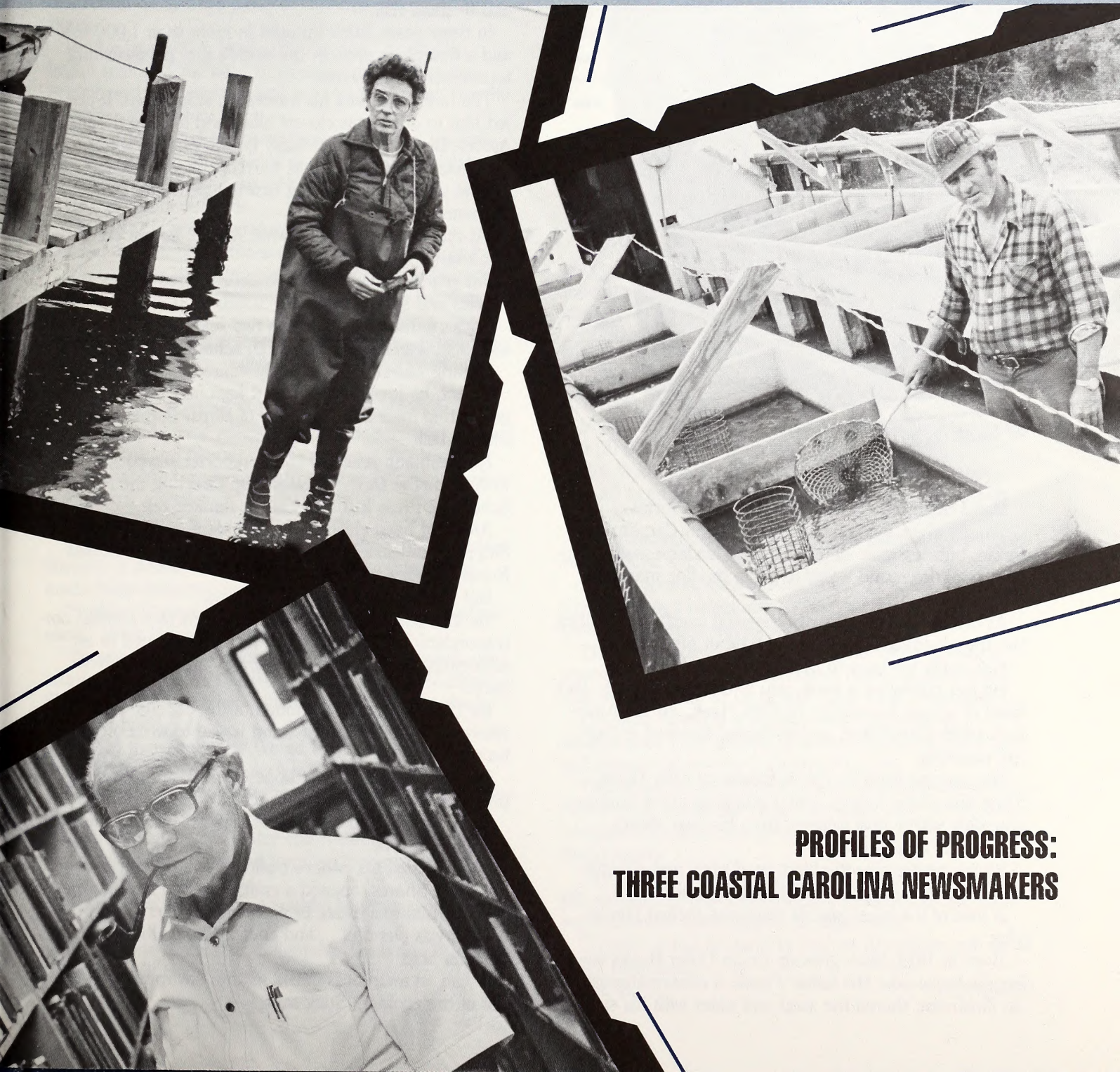
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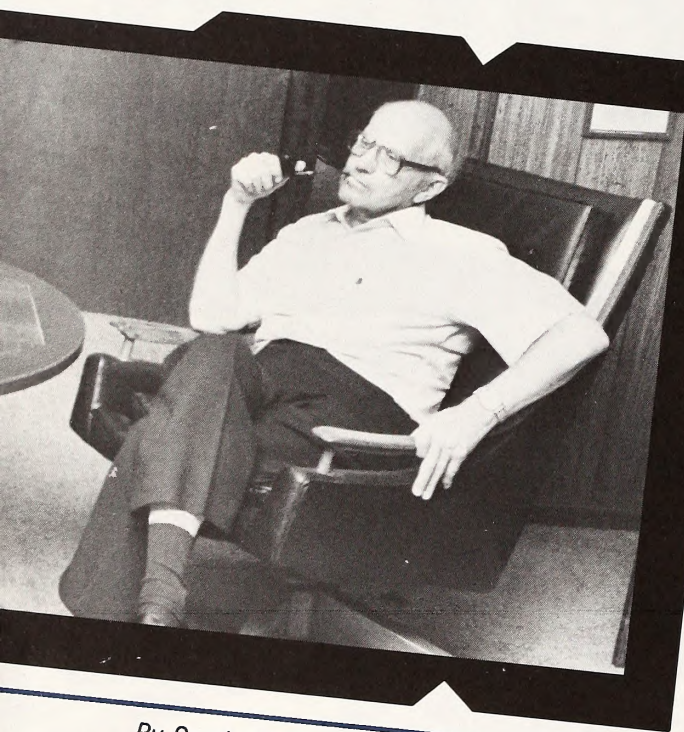
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COAST WATCH



**PROFILES OF PROGRESS:
THREE COASTAL CAROLINA NEWSMAKERS**

Editor's Note: This month *Coastwatch* recognizes three outstanding coastal Carolinians. In their own ways, they have helped shape the North Carolina coast. Author David Stick recorded the coast's past and molded its future through his progressive thinking in coastal management. Fireball Lena Ritter incited shellfishermen to save their pristine harvesting waters from development. And fisherman Murray Bridges "busted" the soft-shell crab industry wide open.



D A V I D S T I C K

By Sarah Friday

David Stick must have a time filling out forms. There's never much room for the North Carolina historian, businessman, developer, civic leader, coastal advocate, book lover and writer to fill in the line marked "Occupation."

As one of the state's most renowned coastal authorities, the trim, balding Stick is modest about his success.

He's really too busy to think about it.

He just published a book, you know. His eleventh. He's head of a local foundation in Kitty Hawk, on the America's 400th Committee, and as always, involved in land use planning.

He's moving from Southern Shores to Kitty Hawk. Then there's the history center going up in his honor—complete with 6,000 volumes from his own library.

And this is retirement.

Stick's progressive thinking, hard work and straight-shootin' style keep him ahead of the game.

A love of the coast and its resources incited him to play.

Born in 1919, Stick grew up on an Outer Banks few people know now. His father Frank, a conservationist and an illustrator, shared the sand and water with his son,

instilling in him an appreciation that would endure.

He had "a love of the outdoors and the amazing ability to paint in a very realistic manner the animals he saw," Stick recalls.

Evidence hangs on nearly every wall in Stick's home.

Drawing on his pipe, Stick also remembers how much his father loved sports—and how much he hated them.

The younger Stick got bored fishing and cried when he shot a duck the first and last time he went hunting.

He liked boats, though, and gogglefishing.

Yes, gogglefishing.

When Stick was 14, a visiting Olympic athlete showed him how to wear the little wooden goggles made in Japan and to spear fish.

In three years, Stick brought in more than 1,000 fish and a first place prize in the world's first gogglefishing tournament in Beaufort.

The hobby sparked his interest in shipwrecks. It also led him to one of his closest allies and lifelong friends, Aycock Brown. The nationally known photographer publicized the Outer Banks for more than 30 years.

That included the world's first gogglefishing tournament.

"At that point, I realized what Aycock Brown could do," Stick says.

For years afterward, the two collaborated on books, articles and special projects.

Stick's writing career began two years after the tourney with a stint as editor of the high school newspaper.

Writing was all he ever really wanted to do.

In fact, he loved it so much it kept him from graduating from the University of North Carolina at Chapel Hill.

His freshman year, the young reporter stayed so busy writing for the *Daily Tar Heel* and directing the N.C. Scholastic Press Institute that he flunked out.

And he'd been elected to the student council, defeating Skipper Bowles, a classmate who became a prominent North Carolina politician.

But "I never regreted it," Stick says.

He later joined the U.S. Marine Corps as a combat correspondent during World War II, then returned to an editorship at *The American Legion Magazine* in New York.

By 1947, he had had enough of the big city. He returned to North Carolina and vowed to write only what he wanted.

In 1952, Stick published one of his first books, and probably his most famous, *Graveyard of the Atlantic*.

But he needed to do more to support his new wife and their family-to-be.

So he joined his father's business as a developer in Southern Shores, opened a craft shop and became the first licensed real estate broker on the Outer Banks.

Land was plentiful ... and cheap. Choice lots went for \$100 an acre.

"I had an awareness of the natural environment, but not of the ecology," Stick says.

"I suppose we all shared the feeling that no action by a single individual or developer could possibly have an appreciable effect on the so-called balance of nature," he writes in *Striking a Balance*, a publication of the N.C. Division of Coastal Management.

But pretty soon Stick saw the folly of people building too close to the ocean. And he shook his head when property for sale frequently flooded.

He saw houses fall over because of erosion, and hurricanes create disaster.

Common sense and an inherited eye for conservation told him something could be done.

He began telling folks at meeting after meeting about respecting nature, the powers of storms and citizens' rights.

By the late 1950s, North Carolina and the nation began realizing the need to protect coastal resources. Stick heard the term "coastal zone management" for the first time about then.

In the 1960s, "when the environmental stuff was getting big anyway," Stick joined some Tar Heel legislators in a push for the Coastal Area Management Act.

Opposition abounded.

The new bill restricted development, banned bulkheads, outlined setbacks and called for planning.

It took more than 10 years, but in 1974, the largest coordinated land use planning effort ever undertaken in this country passed.

After the victory, Stick was appointed vice chairman, then chairman of the policy-making body created by CAMA.

Today Stick is proud to have been a part.

CAMA made local officials and developers take a closer look at what was happening to our coast, Stick says. Gains have been made to protect our economy as well as our natural resources.

But development pressures continue.

"These fragile islands can accommodate only a certain amount of people without losing the very things that made them attractive in the first place," Stick says.

"Nothing is wrong with development; it's overdevelopment." Stick believes the answer is in planning.

"People say Southern Shores is a well-developed community," he says. "As I developed each area of Southern Shores, I tried to envision the best I could when there was total build-out.

"Would there be trees? Would there be roads, and would there be adequate services?"

The mistake many planners made, he adds, is that they looked only five years ahead.

Stick also advocates better enforcement of the laws dealing with the coast, and improved ways to inform the public of the issues.

Newspapers, politicians or public hearings won't do, he says.

One-on-one discussion, neighbors discussing their problems, will bring about change. •



By Nancy Davis

There was a time when Lena Ritter couldn't name the Onslow County commissioners. She didn't attend public meetings, and she wouldn't have dreamed of making a speech.

Like the seven generations before her, Lena was a fisherman. She and her husband Graham lived 300 feet from where she was born and half a mile from the sound that had always fed and clothed her family.

She had only seen the mountains twice, and Graham was 50 before he ever spent a night in a motel.

But in December 1982, a newspaper article transformed Lena from a complacent fisherman to a civic activist.

The headline read, "Plans for new marina, condo project unveiled."

A developer wanted to turn pristine Permuda Island into a planned community of 383 condos, four tennis courts, two swimming pools and a marina.

The developer touted his plan as an Onslow County version of South Carolina's Hilton Head—a description that didn't appeal to Lena and other local fishermen.

Permuda Island is a slender, mile-long strip of undeveloped land nestled in Stump Sound between Topsail Island and mainland Onslow County.

The island is small, but it is surrounded by some of the state's most productive clam and oyster beds. Lena knows because she's spent the better part of her 51 years fishing those waters.

She and other local fishermen believed rainwater and silt running off the development's roofs, roads and parking lots would harm nearby shellfish beds.

"I wasn't going to stand by and let developers rob us of that," Lena says.

She didn't.

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She flung herself into a controversy that has repeated itself up and down the North Carolina coast for the past decade. It was tradition vs. change.

And Lena won.

In December, after a series of denied construction permits, the developer sold half the island to the N.C. Nature Conservancy and gave the conservancy an option to buy the remainder. In February, the N.C. Council of State approved the purchase of the conservancy's half of the island.

The state plans to preserve Permuda Island for teaching and laboratory work.

Lena's reward for her four-year struggle was more than seeing Permuda Island safe from development.

In November, the Z. Smith Reynolds Foundation awarded her one of three Nancy Susan Reynolds Awards. She received a \$5,000 personal award and \$20,000 for charitable contributions, which she donated to the N.C. Coastal Federation and to two local volunteer fire departments.

These days Lena would still rather talk about fishing than anything else. But you're just as likely to hear her discuss zoning issues, primary estuarine nurseries and stormwater runoff.

"I'm not opposed to development," she says. "I just want it done in a safe manner.

"The only attraction we've got to outside money is that water. People don't come down here to look at our woods. If we want them to keep coming, we've got to take care of our water," Lena says.

She is sifting through a clutter of scrapbooks, photo albums and a foot-high pile of newspaper clippings yet to be filed. The collection chronicles Lena's crusade to save Permuda Island.

"You work for four years, frustrated, aggravated, people staring down their noses at you. And then you get one phone call, and it's all over," Lena says, her ever-present cigarette filling the room with smoke.

At first, the high school graduate seemed an unlikely

candidate for the job she took on. But the article in the newspaper scared Lena into action.

She wrote a letter to the editor and got the shellfish leaseholders around Permuda to sign it.

Then she called the reporter who had written the article and said, "Please get on the other side of the creek and find out what's going on."

The reporter agreed, and within 45 minutes, Lena had rounded up 17 fishermen to meet him in her living room.

She had managed to light a fire under folks not known for being joiners.

But they did join the fight. Over 200 fishermen banded together to call themselves the Stump Sound Shellfishermen Coalition.

"It was truly a grassroots movement, and people who were going to be affected really got behind it," says Todd Miller, executive director of the N.C. Coastal Federation.

"Lena is just a fireball. She doesn't admit to being able to arouse people. But she has an ability to stand up and speak for what she believes in. It's a natural leadership ability that she possesses," Miller says.

The coalition held bake sales, yard sales and auctions. They built a 16-foot wooden skiff, christened it the *Permuda I*, and sold raffle tickets for \$5 apiece. With the money they raised, the coalition hired a lawyer to argue their case.

In her 1973 Chevrolet, Lena attended more public hearings and planning board meetings than she can remember.

"I've ridden to Raleigh in everything from a chartered bus to a pickup truck to a Cadillac. If my car wouldn't make it, a neighbor would take me," she says.

To help pay some of her costs, Lena took a job making boxes at a nearby factory. But every minute she spends inside, she hears the waters of Stump Sound calling.

"Sometimes when I'm in there, I just want to take my elbows and push the walls out. I like to be free and on the water," she says.

Even with all the organization, the coalition didn't win all the skirmishes in the battle. In fact, sometimes it seemed that everything was against them, Lena says.

Most of the county commissioners were sympathetic with the developer. But when the N.C. Division of Coastal Management refused to issue a construction permit in 1985, the owner sold the island to another developer.

The victory was temporary.

The new developer announced plans for another housing development.

In September 1986, the state denied him construction permits.

But Lena didn't feel victorious until she got a call from the director of the Nature Conservancy.

Lena's battle was over, and Permuda Island was safe.

"But how many more Permuda Islands are there up and down the coast?" Lena says. "Our heritage, our culture, our environment, our clean water—it's not for sale at no price. I tell people, 'Don't sit down and let 'em take it away from you.'" •



MURRAY BRIDGES

By Kathy Hart

Normally on a sunny June morning Murray Bridges is either tending the crab shedders behind his house or on the water in his boat.

But this morning, Bridges' sons, Otto and Scott, insisted that he leave work behind and take a seat in front of the television. They set the channel for NBC's "Today" show and left Bridges to watch.

For nearly two hours Bridges gazed at the set as "Today" show hosts Bryant Gumbel and Jane Pauley intermittently discussed the North Carolina coast from their shipboard location near Wilmington.

Finally about a quarter until nine, the words "soft crabs" rolled off Gumbel's lips, and Bridges hollered for the family to join him.

Seconds later, the program cut to a prerecorded spot.

There, before several million viewers, was Colington's own Murray Bridges and his wife, Brady, shedding crabs.

Today Bridges chuckles about his network appearance and admits shyly that he "had fun" watching the morning program.

But nationwide television exposure wasn't one of Bridges' goals 12 years ago when he began to hold blue crabs for their impending molt.

Making a living was.

Employing ingenuity, hard work and good common business sense, Bridges made a living and a reputation as one of the biggest, best and most innovative soft crabbers in the business.

No doubt about it, it's a business that's cracking out of its shell.

Soft crab landings in North Carolina have increased over 600 percent in just four years. And it's all because people are biting at the chance to sink their teeth into the sweet, soft blue crab.

In fact, "Today" show researchers learned about Bridges from an article in an airline magazine about soft crabbing.

Newspapers and magazines have touted Bridges' success, often placing a portion of the responsibility for Dare County's \$1 million soft crab industry on the shoulders of this unassuming fisherman in the striped cap and flannel shirt.

Undoubtedly, Bridges opened a lot of fishermen's eyes to the profits gained from and the skills needed for shedding crabs.

He's led seminars in the state and out. And he's answered hundreds of questions from callers and visitors.

"If I can help somebody I will," drawls Bridges in his High Tider accent. "People helped me."

"People get worried with me around here for being so open. But I tell them they wouldn't have done it (soft crabbing) if I hadn't been here."

When Bridges began shedding crabs, he was one of only a handful of crabbers in Dare County willing to fool with the ornery crustaceans.

"I learned about shedding crabs from my wife and her mother," he says. "They've always shed crabs in Colington."

The first years for his family-operated business were lean ones, Bridges admits. In fact, Brady Bridges named the shedding operation Endurance Seafood Co. in remembrance of the hard times.

But gradually from Sea Grant, other crabbers, publications and trial-and-error efforts, Bridges learned about the business and the biology of shedding crabs.

At first, Bridges detected a crab's impending molt by watching for the crustacean's abdominal apron, or flap, to turn pink. But only female crabs' aprons changed color.

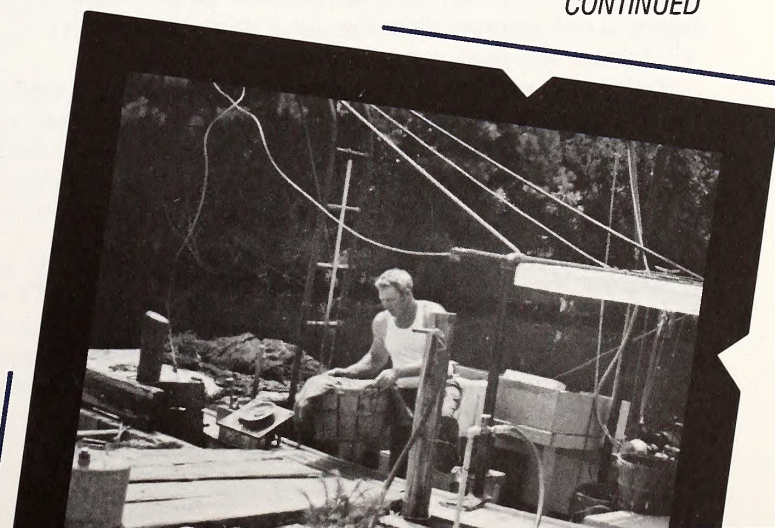
"In those days, we probably threw 90 percent of the male peelers (crabs about to shed) away," he says.

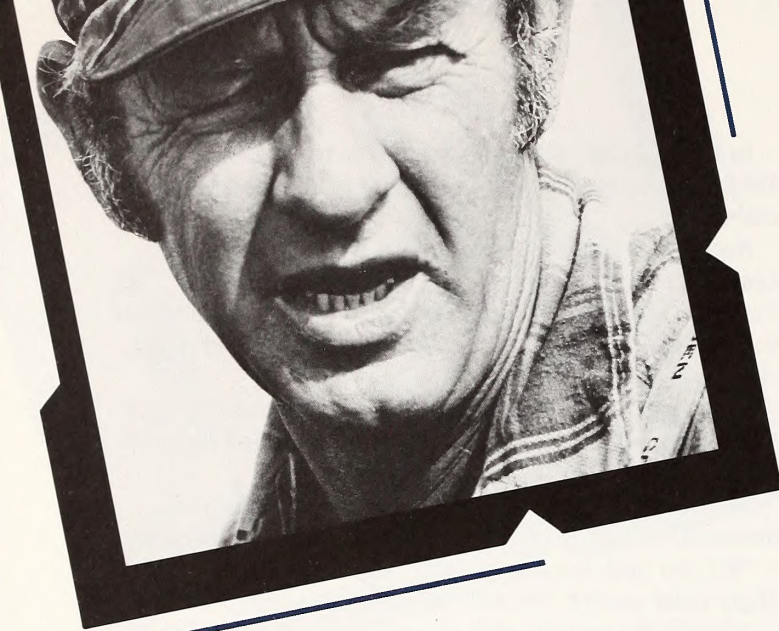
But not so today. At a Sea Grant workshop, Bridges was taught to read, or sign, peelers by detecting the color change in the last joints of the paddler fin.

And through experimentation, Bridges became the first crabber in North Carolina to move his shedder trays from the sound to the shore.

Crabbers traditionally floated wood-slat trays along

CONTINUED





creek and sound edges. But netting the soft-bodied crustaceans was back-breaking labor.

Bridges substituted concrete vats for wooden trays, placed the vats on concrete block legs and filled them with brackish water pumped from a nearby creek.

"Everybody said it wouldn't work," he says. "But I couldn't see why it wouldn't."

The onshore system worked fine, and it wasn't long before Bridges began to expand his operation—six shedder bins, 10, 16. . . .

Today, Bridges fills 145 vats with peelers during May, the prime shedding month.

And with so many vats to fill, Bridges no longer has time to catch his own peelers during May. He buys peelers for 30 cents apiece from crabbers within a 100-mile radius.

Single-handedly, Bridges has created a market for peeler crabs in Dare County.

In one day last year, Endurance Seafood Co. handled over 23,000 peelers; in one week, over 120,000.

When the vats brim with peelers, the hands of Bridges, his wife, his two sons, his daughter, his sister-in-law and his children's spouses work feverishly to handle peelers and soft crabs.

During May, the family works 24 hours a day.

Crabs can shed at any time but seem to prefer the night. And they're at their peak softness for just a few hours. If not removed from the water then, their shells will harden and their value decreases.

So Bridges and his family maintain a 24-hour vigil over the shedder vats, waiting to scoop up the spongy crustaceans. Some nights the crabs molt as fast as the family can scoop.

Bridges says he shed over 1,100 dozen crabs in one night last spring.

"During May you don't talk to nobody around here," he says. "They'll bite your head off."

"It takes the long hours though. That's why everybody doesn't get into it."

But if the hours are long, at least the profits are good.

During the last weeks of April before crabs shed on the Chesapeake, Bridges can receive \$17 to \$18 a dozen for soft crabs. But when the Chesapeake supplies arrive at market, prices drop as low as \$8.50 a dozen for jumbo soft crabs.

But before you start multiplying \$8.50 by 1,100 dozen, Bridges says to consider the costs.

They include peelers, electricity, packing materials and salaries. And, of course, there were the investments he made in vats, pumps, PVC pipe, hose, lights and a freezer. "You have to turn a lot of crabs to make money," he says.

But for prospective soft crabbers, Bridges spells out the costs and benefits. Folks have come from as far away as Mississippi and Texas to view his operation and take his advice.

"So often people think you have to have just the right water, just the right temperature," he says. "They're intimidated."

"But when they see what I got here they know they can do it too. You can shed crabs in bathtubs, buckets or tubs if you have to."

As long as Bridges can draw a breath, he'll be interested in the blue crab. He admits that watching the clawed crustaceans shed their shells holds a special fascination.

"I'll shed crabs until I die," Bridges says. "I want to gradually turn the business over to the boys. But my wife says I'm too nosy to stay away from the shedder trays."

"The boys want me to devote all my time to selling. But I tell them that I want to see those crabs shed." •



THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



In February, Sea Grant randomly surveyed 577 of its *Coastwatch* readers. We wanted to find out about our subscribers and what they thought of our newsletter.

We learned that 55 percent of our subscribers have been reading *Coastwatch* for three or more years. Another 35 percent had subscribed for one to three years; 10 percent, for less than one year.

Each copy of *Coastwatch* is read by 2.6 people. Sea Grant has 14,633 subscribers on its mailing list. That means over 38,000 people read *Coastwatch* each month.

We add 25 to 75 new subscribers to our list each week.

Readers voted (87 percent) overwhelmingly in favor of our single-topic approach to *Coastwatch*. And over 95 percent of those surveyed read "The Back Page" and found it helpful.

The survey also indicated that 58 percent of our readers have ordered other publications from the program.

On a scale of 1 (best) to 5 (worst), readers gave *Coastwatch* the following ratings: attractiveness, 1.98; timeliness, 1.75; informativeness, 1.34; ease in reading, 1.11; and helpfulness, 1.61.

Today, it costs about 15 cents to write, edit, design, print and mail each copy of *Coastwatch*.

Although we'd like to look as slick as *Time* or as colorful as *Southern Living*, we keep production costs down by printing in just two colors, using non-glossy paper and taking some of our own photographs.

A special thanks to those of you who participated in the survey. We read every survey form and will take into consideration all of your suggestions.

The catch of the day off North Carolina's northern shore is often tuna. Commercial and charter-boat fishermen have increasingly targeted this pelagic fish.

Sea Grant would like to help fishermen sell their catch by providing them with information about handling and marketing their fish.

This information will be provided at an April 22 seminar, "Tuna Quality: What's in it for me?" The seminar will be held at 7:30 p.m. at the N.C. Aquarium on Roanoke Island.

David Green, Sea Grant's seafood extension specialist, will discuss the quality and handling aspects of tuna. Skip Kemp, the program's seafood marketing specialist, will talk about market supplies and demands for the pelagics.

For more information about the seminar, call 919/473-3937.



Carteret County oystermen say this winter's fishing was some of the best they can remember. Statistics verified their claim.

In December 1986, fishermen collected 250,000 pounds of oyster meat. A year before, they harvested 140,000 pounds.

North Carolina's oystermen have been lucky, says Mike Marshall, a shellfish biologist with the N.C. Division of Marine Fisheries.

Low rainfall and high salinities created near-perfect conditions for young oysters in 1984 and 1985.

And no cases of oyster diseases have been documented in the state in the past few years.

Oyster harvests in Virginia, South Carolina and some Gulf states declined drastically because of two diseases. Their low supplies created a high demand for North Carolina oysters.

In addition, some areas have been more productive because of DMF's oyster bed management program, which was expanded in 1980.

DMF replants tons of shell material to provide beds for larval oyster attachment. And in the off-season, the division pays fishermen to move oysters from polluted areas to cleaner beds.



If you want to harvest a meal of blue crabs, all you really need is a baited string, a net and plenty of time and patience.

But with your own crab pot, you can make the fishing easier and catch as many as a dozen crabs in a few hours. Best of all, the pot doesn't have to be tended.

Building your own crab pot is simple. Constructed of wire mesh and baited with fish heads or fish remains, the trap is designed to allow an easy entrance, but a difficult escape, for the crab.

For the project, you'll need a few materials from the hardware store and a copy of Sea Grant's *How to Build a Crab Pot*.

The 14-page booklet guides you through a step-by-step method for constructing a crab pot and advises you of regulations you'll need to know.

For a free copy of *How to Build a Crab Pot*, write Sea Grant. Ask for UNC-SG-80-03.

For fishing, fun and friendly rivalry, attend one of the state's 30 saltwater sportfishing tournaments.

From Currituck to Calabash, fishing clubs, marinas and civic groups sponsor these fishing frenzies. They last from one day to one week. And depending on the type of tournament, anglers may vie for croaker, flounder, mackerel or marlin.

Many sportfishermen plan their vacations and weekends around these fishing contests. That's why Sea Grant publishes a brochure that lists the dates

Continued on next page

and sponsors for these competitions.

The brochure also provides information about the year-long North Carolina Saltwater Fishing Tournament sponsored by the N.C. Division of Marine Fisheries.

For a copy of this free tournament brochure, write Sea Grant. Ask for UNC-SG-87-02.



The Atlantic blue crab is making an unwelcome splash in Pacific waters. It seems that West Coast seafood lovers are buying the blue crabs at fish markets.

But instead of serving them up as a feast, the nature lovers are releasing the crabs.

Before you cheer their liberation, consider this. The feisty blue crabs may be threatening the lives of the native species, including the Dungeness crab.

The blue crab is fast, voracious and capable of beating the Dungeness to a

meal. Biologists are warning that the non-native blue crab could make life difficult for the Dungeness.

In fact, the blue crab has already made itself at home in the foreign waters. Fishermen have even reported catching a few in the waters around San Francisco.

When stories of the unusual catches made the news, folks started fessing up. The *Chicago Tribune* reported that one liberator confessed that he had released 40 Atlantic blue crabs.

The N.C. Marine Fisheries Commission will hold public hearings across the state in May to present 28 proposed fisheries regulation changes. Commercial and recreational fishermen are encouraged to attend.

The hearings will be held at 7:30 p.m. at the following locations: Hatteras, Hatteras Civic Center, May 18; Manteo, N.C. Aquarium on Roanoke Island, May 19; Washington, District Courthouse, May 20; Morehead City, Carteret Technical College, May 21;

Wilmington, New Hanover County Courthouse, May 26; Raleigh, McKimmon Center at North Carolina State University, May 27; and Winston-Salem, Agricultural Extension Center, May 28.

The Marine Fisheries Commission will meet in June to make final decisions on the proposed changes.

For more information, contact Jim Tyler at the N.C. Division of Marine Fisheries. The toll-free number is 1-800-682-2632.

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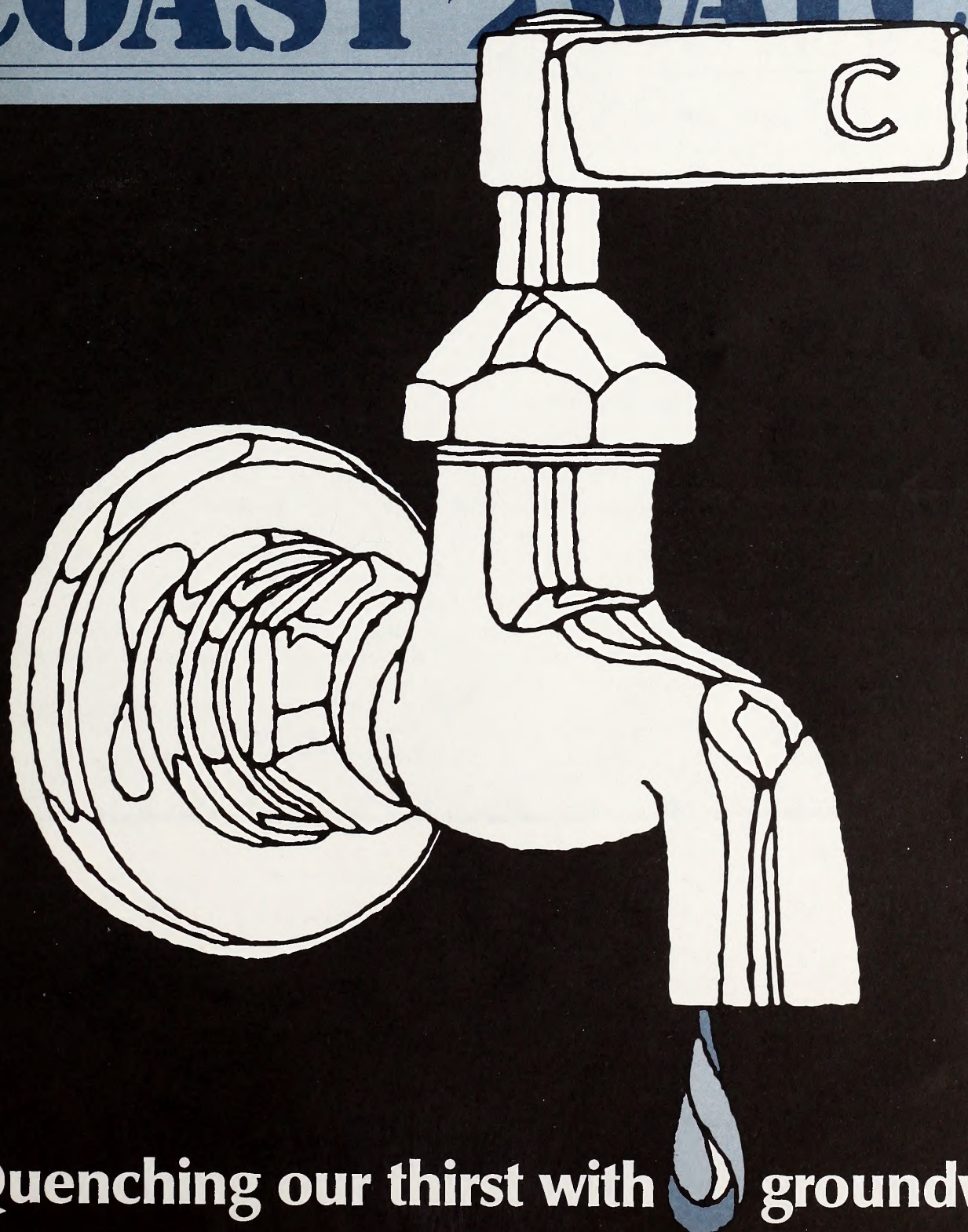
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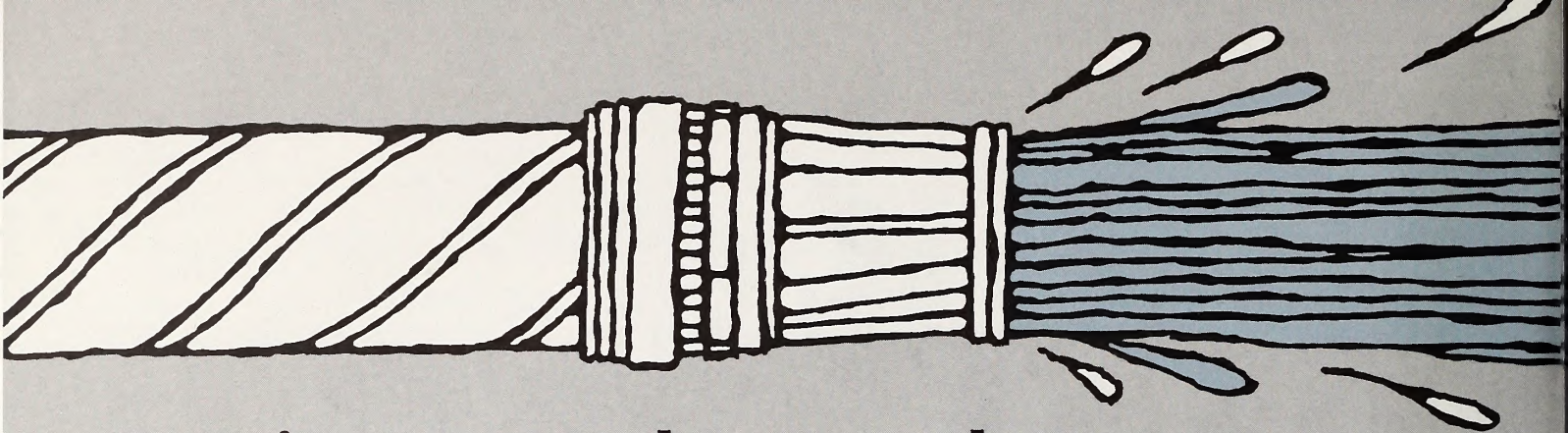
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COAST WATCH



Quenching our thirst with groundwater



Tapping our underground resource

You walk to the faucet, turn the knob and out pours cup after cup of water.

But where does that water come from?

At first thought, you'd probably answer the county reservoir or your backyard well.

But that's only an intermediate stop in the water's path to your faucet.

Where does it really come from?

For 55 percent of North Carolina's residents, it's drawn from the ground and is aptly called "groundwater."

To drink, flush, wash and rinse, North Carolinians withdraw about 770 million—over three quarters of a billion—gallons of water from below the earth's surface each day.

That's a large amount of a limited resource.

Less than 3 percent of the earth's trillions of gallons of water is fresh. And three-fourths of that 3 percent is frozen in polar ice caps and glaciers.

About one-half of 1 percent of the world's fresh water is groundwater. And 1/50th of 1 percent empties into rivers, lakes and streams.

Sure, rainfall replenishes groundwater supplies. But perhaps not fast enough.

Rain must trickle through foot after foot of soil to reach natural storage areas. It can take days,

weeks or months, depending on the topography, soil characteristics, vegetation, land use and precipitation amounts.

But in just minutes a pump and well can send gallons of this collected moisture shooting to the surface for industrial, agricultural, municipal and residential use.

A breakdown of groundwater use in North Carolina follows this pattern: 64 percent industrial, 18 percent residential, 9 percent agricultural and 9 percent municipal.

Along the state's Outer Banks and Coastal Plain, most municipalities, industries and residents quench their needs with groundwater.

In the Coastal Plain, wells suck water from large underground aquifers. Aquifers are layers of porous rocks that yield water.

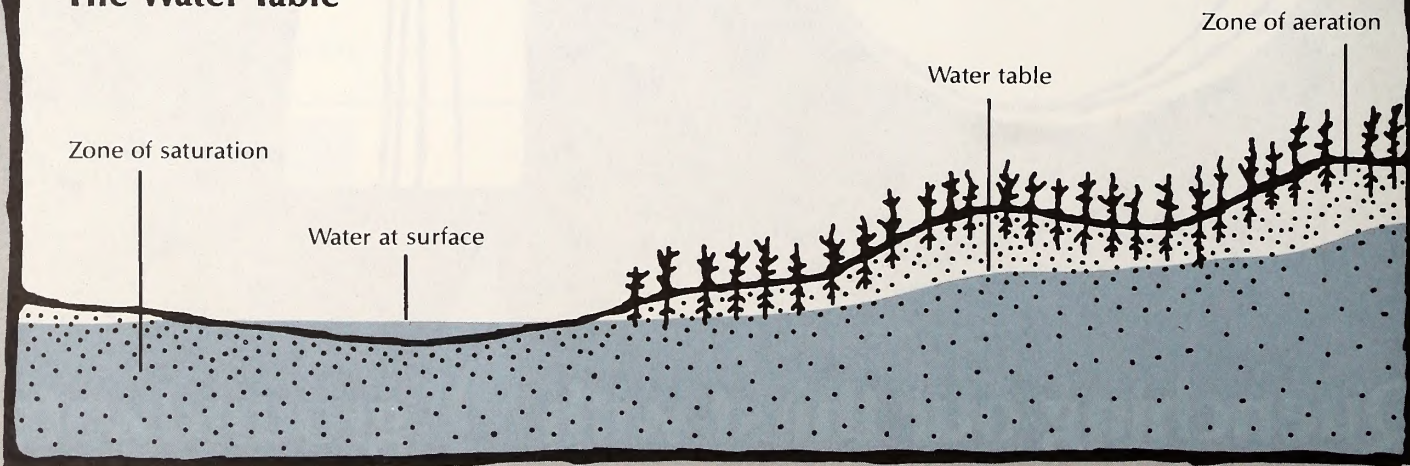
Contrary to popular belief, there is no subterranean lake or river flowing beneath our feet.

Instead water collects between and inside porous rocks such as limestone. It moves vertically and horizontally as it slips and slides in contour with the earth's surface.

Geologically speaking, underground water divides into two zones.

The zone immediately beneath the land's sur-

The Water Table



By Kathy Hart

face is the aeration zone. Water and air bubble through this zone.

Underneath is a zone where all of the rock openings are full of water. This zone is the saturated zone, and the water taken from it is groundwater.

The water table marks the top of the saturation zone. The depth of the water table varies with the topography of the land, the climate and the amount of rainfall.

The water table rises above the ground's surface in lakes, streams and swamps. But it may fall hundreds of feet below a desert.

Along the barrier islands and nearshore coastal areas, the groundwater system acts differently. Salt water infiltrates the aquifers.

When this occurs, the water that collects from rainfall forms a freshwater lens which floats on the underlying, denser salt water.

From Ocracoke north along the Outer Banks, this freshwater lens is the only source of drinkable water with the exception of a small lake near Nags Head.

The lens, which begins only a few feet below the land's surface, may be 25 to 100 feet deep and is solely dependent on rainfall for replenishment.

"On the Outer Banks you have a very finite amount of resource because there's not a lot of land for infiltration of rain," says Allan Dietemann of the N.C. Division of Water Resources.

And Dietemann says this limited resource is quenching the thirst of an expanding population that swells by sixfold during the hottest, driest season of the year.

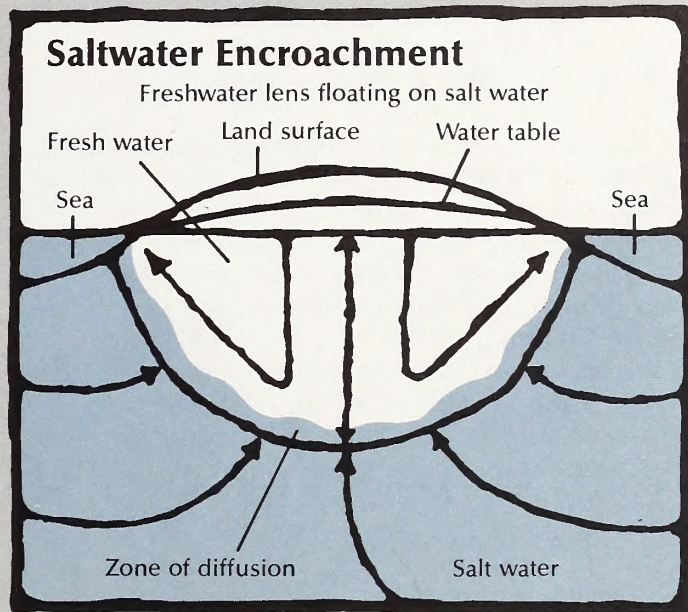
Therein lies the problem.

As more houses and businesses suck water from the lens, it diminishes. And when water supplies decrease, problems are created that are characteristic to barrier islands everywhere.

Wells can go dry. Or they can draw salt water from the aquifer below or partially treated sewage from the septic tanks nearby.

These problems haven't reared their heads along North Carolina's barrier islands. Outer Banks city

Adapted from "Basic Elements of Ground-Water Hydrology"



and county planners are making sure they don't by planning for the future (see story, page 4).

On the barrier islands south of Ocracoke, water supplies are more abundant. A deep freshwater aquifer exists beneath these islands.

"There's plenty of groundwater available to the south," Dietemann says.

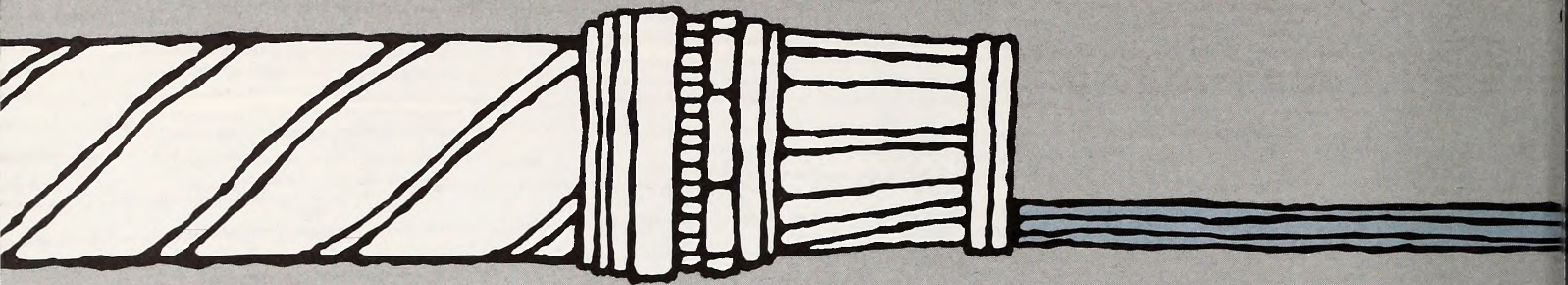
"There, it's just a matter of how to pump it, who pays for it and how to handle the fluctuating needs caused by tourists."

But quantity isn't the only concern among residents in coastal North Carolina. Quality is also a worry.

People are realizing that the wastes that are pumped and dumped into our soils are potential contaminants for our water supply.

"At meetings and hearings, people express strong opinions about the quality and quantity of their water supplies," says Perry Nelson of the N.C. Division of Environmental Management.

"That's why it's important now to make a careful evaluation of those supplies and a careful evaluation of what affects those supplies. Water definitely affects our quality of life."



Outer Banks plans for tomorrow's thirst

Nobody has to tell John Bone how important water and tourism are to the Outer Banks.

Most of the jobs there depend on that successful combination.

So when Dare County imposed a moratorium on new water hook-ups two years ago, his office was flooded with phone calls.

"People were saying, 'I heard you don't have any water. Should we still come on our vacation?'" says Bone, executive vice president of the Outer Banks Chamber of Commerce.

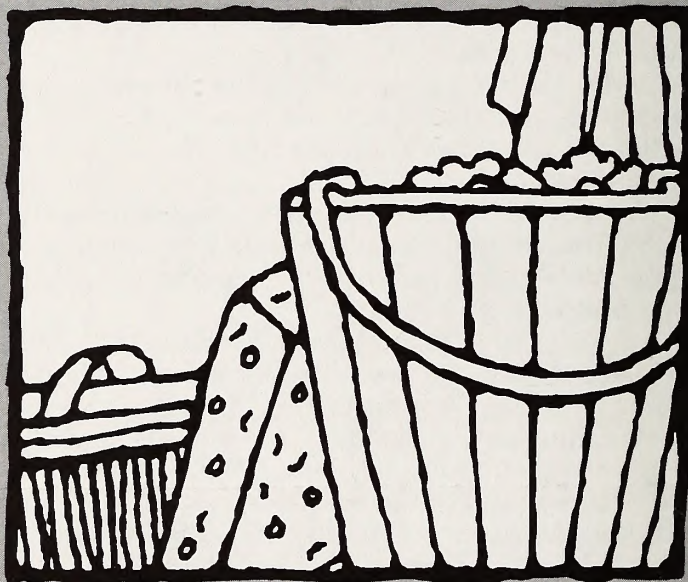
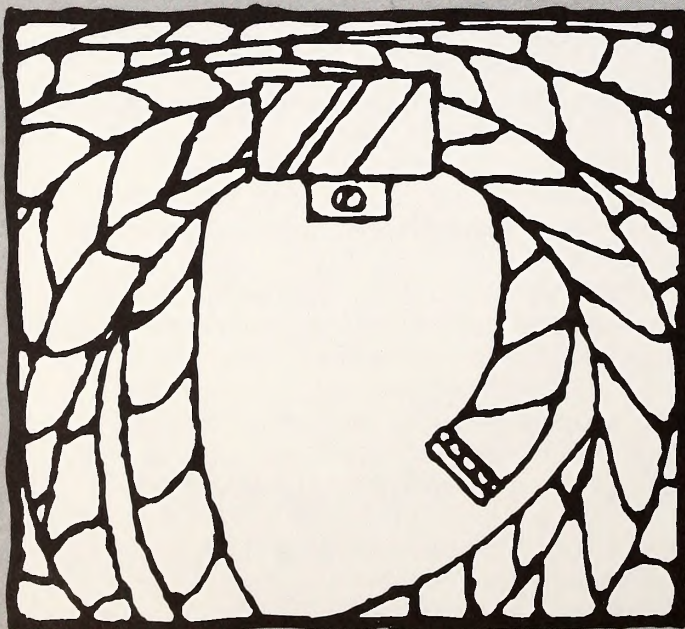
Bone convinced the tourists that faucets weren't dry. The moratorium was simply a protective measure to keep development from outstripping the water supply.

When the season was over, vacationers had spent \$303 million in the county.

But the moratorium sent a message to everyone who visits or lives at the coast.

Water is a finite resource, and we can't wait until we're out of it to start planning for the future.

That philosophy is especially true for North Carolina's Outer Banks, where the only drinkable groundwater is a very thin layer of fresh water.



The building boom presents an added threat to that fragile system, says Perry Nelson of the N.C. Division of Environmental Management.

According to census figures, Dare County's population increased 28.9 percent from 1980 to 1985. That's the fastest growth rate in the state, exceeding rates in metropolitan areas such as Mecklenburg and Wake counties.

The increased development worries Nelson. He and other hydrologists predict that it will be water, not land, that may eventually limit development on the Outer Banks.

Bone emphasizes there is no lack of water now. But he admits the economy of the area could shrivel without careful planning for the future.

Now Dare County relies on three sources of water.

A regional system serves the county from a well field in Wanchese. And a freshwater pond operated by Nags Head supplements the regional system. Each town in the county is allotted a certain percentage of the water.

The Hatteras Water Association serves residents south of Avon. And individual wells are dotted throughout the county.

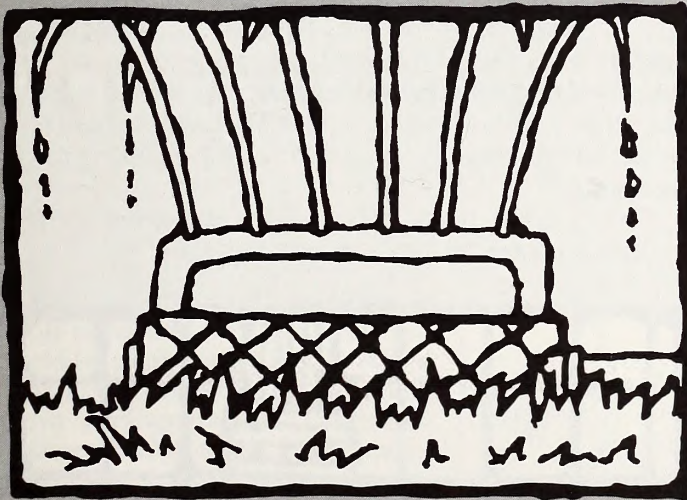
By Nancy Davis

Now the regional water system has a production capacity of about 6 million gallons of water per day.

But a study conducted by an engineering firm estimates the demand for water could increase by as much as 15 million gallons per day by the year 2000.

In the winter, there is plenty of water. But on a peak summer weekend, tourists push the population to as much as six times its off-season level.

While they're there, they use a lot of water. They swim in it, bathe in it, guzzle it and flush it.



Allan Dietemann, of the N.C. Division of Water Resources, says it's like thousands of people putting straws into the same soda. Pretty soon, the glass is no longer full.

And there are no free refills.

Webb Fuller, town manager of Nags Head, has grappled with the water issue for the last five years.

The figures he deals with are in millions of gallons. But he knows that every drop is precious.

Three years ago, Fuller and other town officials realized that if they didn't do something, there wouldn't be enough water to keep pace with all the buildings going up on the beach. (Nags Head was not affected by Dare County's building moratorium.)

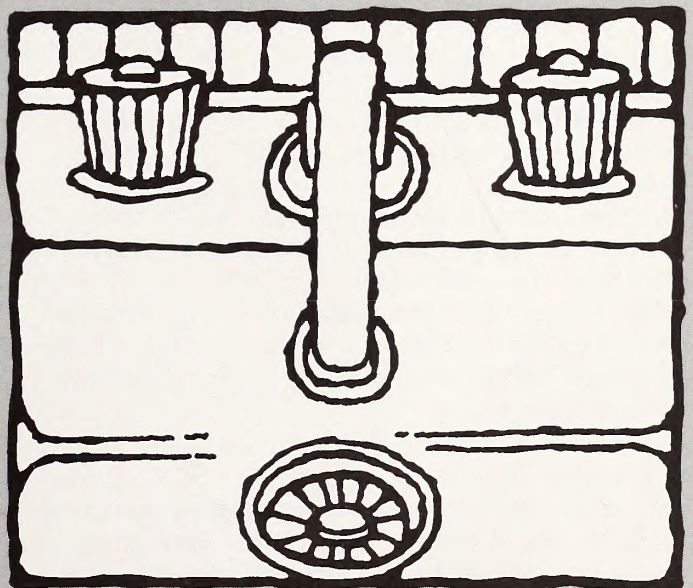
So Fuller devised a formula for doling out water to new construction projects.

"We didn't want to let growth go and use up all our water," he says.

Under the formula, residential buildings are allotted about 65 percent of the water, and commercial buildings receive about 35 percent.

Hook-ups for new residential construction are handed out on a lottery basis. Commercial hook-ups are reviewed twice a year.

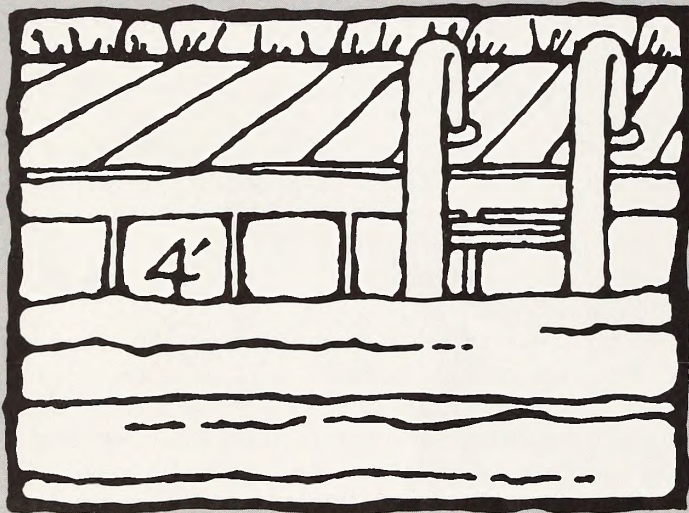
The price of water in Nags Head isn't cheap. In addition to the cost of hook-ups and labor associated with water, residents must pay a \$2,000 impact fee. Before you can turn on the water in a new home in Nags Head, you'll probably pay about \$3,000.



So far, developers have swallowed the high fees without much complaint.

Instead of hampering development, the method provides a patterned approach to development, Fuller says.

Soon residents also will be paying for a new reverse osmosis, or desalination, plant. Pumps will draw brackish water from an aquifer below



the freshwater lens. Then the water will go through a process to remove the salt.

At a cost of \$8 million to \$10 million, the plant is scheduled for completion in 1989. It will increase the region's water capacity by 8 million gallons a day.

Desalination is nothing new. In water-poor countries such as Saudi Arabia, desalination is often the only alternative.

But it's an expensive alternative. Nags Head's reverse osmosis plant may raise the cost of 1,000 gallons of water from 72 cents to an estimated \$1.30, Fuller says.

Farther south, the Cape Hatteras Water Association supplies water to Hatteras, Frisco, Buxton and Avon. In addition to expanding its pumping capacity, the association has taken steps to conserve its water supply by limiting development in its well fields.

Jack Rollinson, manager of the association, says it's more than a problem of too many people, too little water.

Some folks just don't realize that water is a premium.

Rollinson has responded with a campaign to increase awareness of the water shortage. He supplies his customers with conservation tips in their

monthly bills. And some realtors have cooperated by handing out packets of information to tourists.

While managers grapple with day-to-day supplies, scientists are learning more about groundwater.

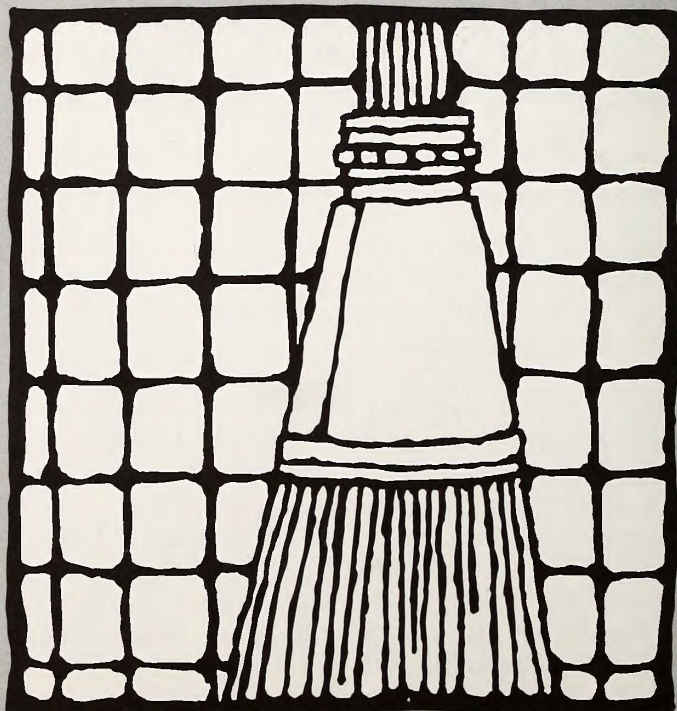
At the U.S. Geological Survey, hydrologists are using computer models to simulate groundwater flow.

With an accurate model, they may be able to predict how much water we'll have for the future, says hydrologist William Lyke.

But the bottom line of the groundwater issue may be how much we're willing to pay for water.

John Kuchnia, of the N.C. Division of Water Resources, says, "We've had cheap water for so long that people can't believe it costs this much. They'll pay \$50 or \$60 for cable TV, but let their water bill go up a dollar, and they'll be calling to complain."

Whatever the price, hydrologists say we're going to have to learn to sip instead of guzzle.



THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



On March 7, 1962, David Stick of Southern Shores almost drowned. The biggest northeaster of the decade was dumping rain and lifting waves over most of the Middle Atlantic Coast. Stick and many others struggled to survive as the storm unleashed its fury for 2½ days.

Fortunately, Stick and all of the Outer Banks' residents lived to tell about the now-famous "Ash Wednesday Storm."

Their stories come alive in a new book by Stick that commemorates the 25th anniversary of the storm.

The Ash Wednesday Storm contains 100 pages of adventure, retold by 160 people associated with the storm. And it includes photos by Walter Gresham III and Aycock Brown, a nationally known photographer who captured the Outer Banks on film for 30 years.

Copies are available in bookstores in eastern North Carolina and Virginia, or by writing Gresham Publications, P.O. Drawer 807, Kill Devil Hills, NC 27948. The cost is \$12.95. Add \$2.50 for postage and handling, and 5 percent sales tax in North Carolina.



University of Delaware Sea Grant researchers have found a use for the mounds of crab shells that are discarded each year by the crab industry.

They're turning the shells into surgical suture thread that slowly dissolves in the body and is nonallergenic. What's

more, the thread has a positive side effect—it promotes wound healing.

The shells of crabs are made of a tough material called chitin. For 50 years, chemists have known that chitin has many useful properties. But before they could find a way to dissolve the shells and turn chitin into a usable form, nylon was invented and claimed most of the glory.

Then, 10 years ago, a Delaware Sea Grant researcher found a way to turn the crab shells into a gooey liquid that could be formed into tough fibers. Now a Japanese firm is using that information to make sutures from chitin.

This isn't the first dissolvable suture invented. But the others often cause allergic reactions and aren't suitable for some areas of the body. Chitin sutures overcome those problems.

Now Delaware Sea Grant researchers are studying powdered chitin's wound-healing properties with an eye to developing an ointment. Early tests show that it not only speeds healing but minimizes formation of scar tissue.



At the grocer's, shrimp sell for \$4.99 to \$12.99 a pound. At those prices, it's hard to stock up on America's favorite seafood.

But what if you could fill your freezer with these delectable delicacies for only the price of few days work and some minor equipment costs.

With a boat, some effort and Sea Grant's booklet, *A Guide to Recreational Shrimping*, you can save money and catch your own shrimp in coastal waters.

The booklet, written by Sea Grant advisory agent Wayne Wescott, provides valuable information about shrimp biology, regulations and types of trawl nets.

With the help of detailed illustrations, Wescott describes how to rig the net, prepare the boat and complete a

successful tow. He offers many tips that can save the new shrimper hours of frustrations.

And he has suggestions for culling and storing the catch.

For a copy of *A Guide to Recreational Shrimping*, write Sea Grant. Ask for UNC-SG-86-07. The cost is \$4.



Few things strike as much fear in a boater as the sight of a waterspout on the horizon. These funnel-shaped clouds are actually offshore tornadoes. And for boaters, they can be just as deadly.

National Weather Service meteorologist Wallace DeMaurice says waterspouts are often associated with summer squalls. And they're particularly prevalent near the Gulf Stream.

Because the twisters weave their way across the water in such an unpredictable pattern, the best advice is to stay off the water when severe weather threatens.

But if you get caught in an offshore squall, use common sense. If you see a waterspout, don't try to outrun it. Instead, move away from it at a 90-degree angle, DeMaurice says.

Report the sighting to the National Weather Service, and listen to your radio for advisories.

If you're in a marina when severe weather threatens, get off your boat and follow the National Weather Service's guidelines for severe weather.

The Gulf and South Atlantic Fisheries Development Foundation has awarded \$20,000 to Sea Grant and the N.C. Division of Marine Fisheries to conduct a research and demonstration project for turtle excluder devices or TEDs.

Sea Grant marine agents and DMF biologists will test two versions of the TED in the state's offshore waters to determine which version performs best. The results of the study will help fishermen decide which TED to use.

Continued on next page



People leave all kinds of things at Pettigrew State Park. But a year ago, a ranger at the eastern North Carolina reserve saw something he'd never forget.

He found two parts of a dugout canoe in Lake Phelps that Indians left behind 3,000 years ago.

The discovery spurred underwater archaeologists to take a closer look. Within months, they found 22 canoes and pottery and stone artifacts submerged in the lake.

The cypress dugouts range from 24 to 37 feet and are in unusually good condition. The acidic quality of Lake Phelps and the absence of bacteria and aquatic life preserved the wood and created a time capsule for the canoes.

Now, many of the markings from construction can be seen. Dugouts were built by burning out the middle of logs, then hollowing the insides with shell and stone tools.

So far, four canoes have been recovered. Two have been radio-carbon

dated, and vary only by 100 years.

The archaeologists hope to find funding to test the rest of the canoes. More information will help them decipher the mystery of the canoes' origins.

One dugout has been on display at the N.C. Museum of History; the others are being treated in Fort Fisher. The visitor center at Pettigrew State Park is exhibiting some of the artifacts.

Preparing seafoods in a microwave oven will do more than save you time. Microwaves cook seafoods rapidly without drying them out, making it possible to reduce fats or oils called for in many seafood recipes.

Remember that overcooking is the most common mistake in preparing seafood. Since microwaves vary in power, be sure to follow the directions in your oven's instruction manual.

Always cook a recipe for the shortest time first, test for doneness, and cook longer if needed.

You can easily convert your favorite seafood recipes to microwave oven

cooking times. Just use similar recipes from your microwave cookbook as a guide.

Sea Grant is publishing a new special-interest newsletter for people in the seafood industry. *Seafood Current* is a quarterly publication about seafood processing, marketing and retailing in North Carolina.

If you'd like to be placed on the mailing list, write: *Seafood Current*, UNC Sea Grant, Box 8605. NCSU, Raleigh, N.C. 27695-8605.

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COAST WATCH



**TRASH
CAN
KILL**



The Plastic Peril

By Nancy Davis

The body of a laughing gull lay in the sand. Fishing line was twisted around its spindly legs and feet.

Ornithologist James Parnell picked up the remaining line that hung from the bird's feet and began to reel it in. No sense in leaving the death trap for more birds.

About 25 yards of line later, Parnell saw that he was too late.

The bodies of five more birds were strung together with a twisted mat of nylon line meant to capture fish, not his feathered friends.

The action was innocent enough. A sportsman replacing the line on his fishing rod probably tossed the monofilament overboard.

First one gull got caught in the line. Then he dragged it back to the colony where the other birds met a similar fate. They may have thrashed about for awhile, trying to free themselves. But eventually they starved to death.

There are other casualties.

The killer is plastic litter.

Each year, thousands of marine mammals, birds and fish are victims of our plastic society. Curious fur seals play in abandoned

fishing nets, get caught and drown. Birds dive through six-pack rings and strangle themselves. Fish swallow indigestible floating plastic pellets.

The result is almost always the same. The synthetic wonder material built to last a lifetime sucks the breath from marine wildlife.

During World War II, shortages of natural resources created a demand for plastics. By the 1970s, over 20 billion pounds of plastics were produced. Last year, plastic production increased to over 47.9 billion pounds.

But the problem is not how much we produce. It's how much we throw away—into our lakes, rivers and oceans.

Plastic is nonbiodegradable, and some plastics are engineered to last as long as 450 years. That means one six-pack ring has the potential to kill over and over again.

The litterbugs vary.

According to the National Academy of Sciences, merchant ships dump about 6.6 million tons of trash overboard every year. Much of it is plastic.

Careless beachgoers also contribute. In Los Angeles County, Calif., picnickers leave behind about 75 tons of trash on beaches each week. Among the discarded are six-pack

rings, plastic bread and sandwich bags and Styrofoam cups.

Commercial fishermen lose or discard tons of plastic fishing gear every year.

Kathryn O'Hara, marine biologist with the Center for Environmental Education, says hundreds of thousands of tons of plastic debris end up in coastal waters each year.

No one knows for sure how many animals plastics kill, but biologists say that for every animal they observe entangled in a net or strangled with monofilament, there are many more that they don't see.

James Coe, program manager of the National Marine Fisheries Service's marine entanglement research program, has been studying the northern fur seal. He estimates that up to 30,000 fur seals die each year after they become entangled in derelict fishing nets and plastic strapping bands.

Each year researchers assess the fur seal population on Alaska's Pribilof Islands. Among the healthy seals on the beaches are those that have encountered marine debris.

"The damage (to the seals) ranges from something wrapped around their neck to some that are hog-tied," Coe says. "Their flesh may be lacerated, and they have ugly, festering wounds."

Although the result may not be immediate death, the entangled seals may eventually die of infection, exhaustion or starvation. It may take a female seal twice as long to forage for food for her young pups. They also may eventually die.

Coe believes the seals become entangled sometime during the nine months they spend offshore.

During that time, nature plays a cruel trick on the seals.

The same currents that concentrate food in an area of the sea also sweep floating debris there. When the seals gather, they get more than they bargained for, Coe says.

Sea turtles encounter a similar problem. "They eat whatever is in the area where their food is supposed to be," Coe says. That includes plastic bags.

On Long Island, N.Y., a researcher reported 11 dead leatherback turtles washed ashore during a two-week period. All had plastic bags blocking their stomach openings.

At the University of Florida Veterinarian School, Paul Cardeilhac dissects about two dolphins each year that have died after ingesting plastic bags.

Sometimes the mammals regurgitate the bags. Most often, the plastic plugs up the dolphin's digestive tract and it dies, Cardeilhac says.

If the plastic dumped at sea doesn't end up in the stomachs of fish or twisted around the neck of a bird, you'll likely find it washed up on the nation's beaches.

In 1986 the non-profit Center for Environmental Education sponsored a beach clean-up in Texas. About 3,000 volunteers picked up trash on a 122-mile stretch of beach.

O'Hara estimates the volunteers picked up 124 tons of trash. In a survey of just half the participants, she found they picked up 15,580 plastic bags, 10,350 six-pack rings, 5,308 plastic milk jugs and 2,432 plastic egg cartons.

In a survey of litter on North Carolina's Shackleford Banks, a National Marine Fisheries Service researcher found an estimated 11,000 plastic bags, 2,400 six-pack rings, 1,100 plastic packing straps, 1,100 Styrofoam cups and 1,350 pieces of monofilament line.

And our state is not without a horror tale or two.

Parnell has seen gulls with six-pack rings around their heads.



He's concerned for those entangled birds, but he also worries about the entire population. When a nesting bird is entangled, it's possible that its nest failed, he says.

But amid the stories of mangled wildlife, there is an occasional happy ending.

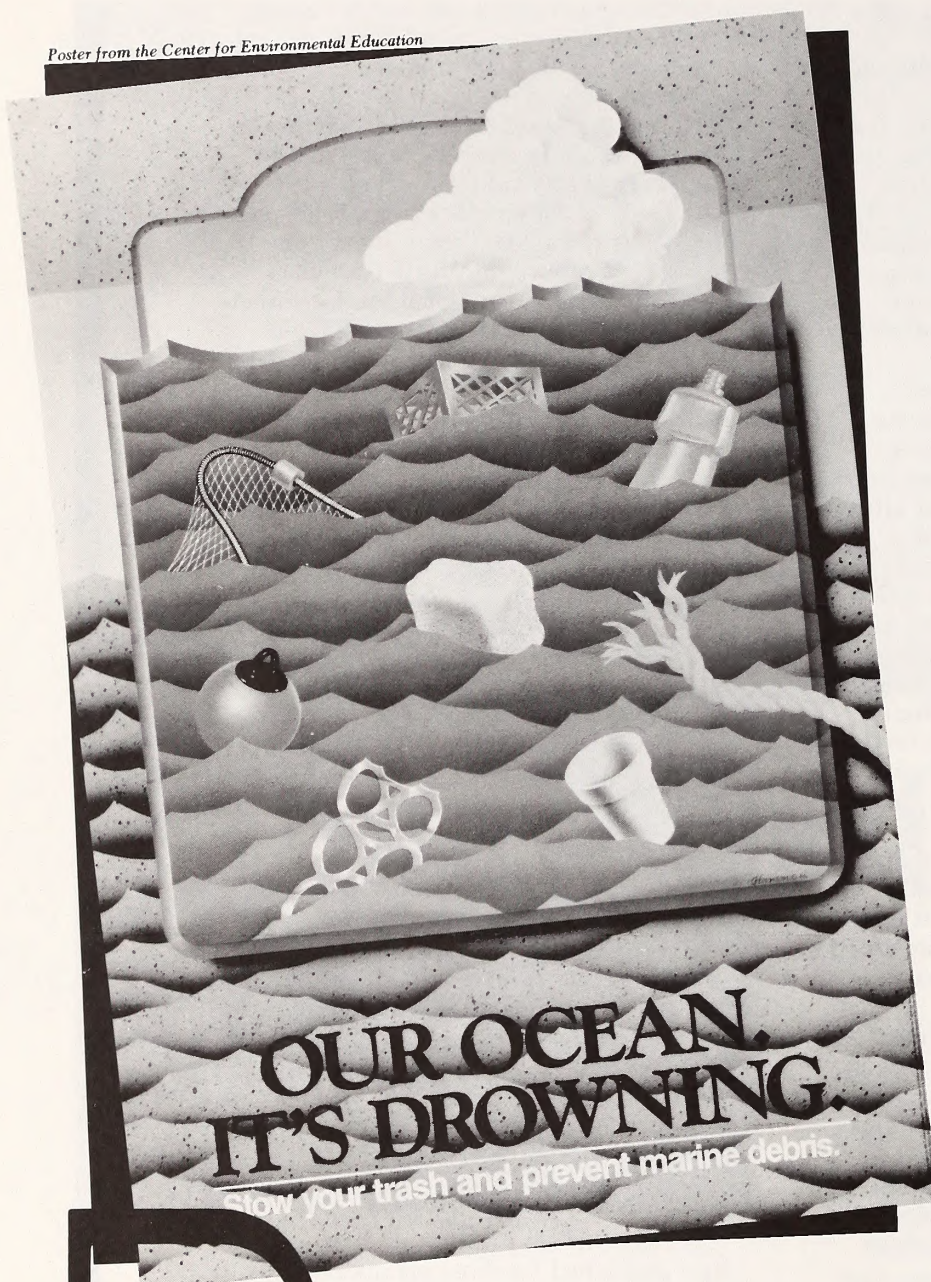
Consider fisherman E.M. Livengood's relationship with a sea gull he's named Georgette.

He and the bird met two years ago on a pier in Nags Head. Georgette's head was poking through the hole of a six-pack ring. One of her legs was stuck in another hole. She couldn't fly, and she could barely walk.

For several days, Livengood fed the gull pieces of shrimp. Finally he caught her in a net and clipped the ring off her.

Now Livengood and Georgette meet regularly on the pier. He takes her pieces of trout from his freezer, and she thanks him by perching on his head.

Poster from the Center for Environmental Education



By Sarah Friday

One person.
One Styrofoam cup.
One ocean.
Nobody will ever know.
Want to bet?

The U.S. Coast Guard estimates recreational boaters generate about 34,000 metric tons of garbage per day.

Add to that millions of tons of daily debris from beachgoers, fishermen and offshore vessels.

The rubbish piles up, snagging, tangling and killing wildlife. But piece by piece it fuels the fire of worldwide efforts to clean up the problem of marine debris.

The efforts range from posters printed to educate the public to massive beach clean-ups in Texas. With all of them, the goal is the same—to save marine mammals.

The campaign has been smoldering for about 10 years. Successes exist, but environmentalists agree only the first rounds of their fight have been completed.

The thrust of their game plan now is education.

"People don't realize what they're doing when they throw things overboard," says environmentalist Jim Murphy of Southern Shores. They don't correlate plastic bags with turtle food or cigarette filters with hungry birds.

Education can change this.

"I think that once people realize the consequences of their actions, if nothing else, their consciences won't let them do it," says Ginny Goblirsch of the Oregon Sea Grant Extension Service. "It's a matter of changing their habits."

Pitch in

"My husband is a commercial fisherman," she adds. "Last year he never thought about tossing stuff overboard. But this year he brings it back in."

Thanks to a new project in Oregon, other fishermen are changing their habits, too.

The National Marine Fisheries Service, Oregon Sea Grant and the Port of Newport organized programs to boost public awareness of marine debris. They did not target commercial fishermen, says Goblirsch, but realized that the nets, rope, gear and litter added to the problem.

Letters, signs and the media urged people to "Show Care for Wildlife, Keep Plastic on Board."

And last year, NMFS gave the Port of Newport a \$97,000 grant for a model refuse disposal project. With education, an incinerator and adequate refuse facilities at the port, the town hopes to demonstrate what fishermen, boaters and merchant ship crews can do voluntarily to reduce the amount of debris going into the ocean.

The problems are different in Texas. Tourists and the Gulf Stream currents produce tons of debris on Texas beaches daily. The currents catch the ocean's garbage and, with strong winds, carry it to shore.

To combat the problem, forces have joined in Texas.

An "Adopt the Beach" program allows businesses, organizations or individuals to claim a section of the beach and clean it at least three times a year.

And beach patrols in certain areas notify, and often fine, litterbugs.

One of the most successful campaigns has been "Texas Coastal Cleanup," sponsored by the Center for Environmental Education, (see story, page 2).

Charlie Moss, a Texas Sea Grant county extension agent, assisted in the cleanup. Now it's his job to identify the offshore point sources of debris. Freighters, ocean liners, oil rigs and platforms are among the culprits.

Currently, no laws prohibit anyone from dumping trash beyond the 200-mile international water line, Moss says.

But the United States is expected to ratify its part of an international provision prohibiting ocean dumping of plastics.

To become law, Annex V of the MARPOL treaty must be ratified by nations representing 50 percent of the world's gross tonnage of debris. So far, 26 nations—or 44 percent—have ratified it. The United States (4 percent) and Soviet Union (5.8 percent) could make the difference.

In addition, seven bills regarding the disposal of plastics and marine debris in U.S. waters are pending in Congress. And numerous state legislatures and research organiza-

tions are taking a closer look at the issue.

In North Carolina, the law keeps some people from trashing the beaches. Anyone caught littering on land or up to 3 miles offshore faces a fine or imprisonment.

A grass roots effort brews in the state to remedy the litter problem.

For four years, Bill Pinkstone and other members of the N.C. Beach Buggy Association have collected trash three times a year along the Cape Hatteras National Seashore.

"Operation Beach Respect" drew nearly 3,000 volunteers in a recent pickup, says Pinkstone, director of the BBA. "We believe that it is working, that people are more conscious of it now."

"We've been lucky that individual groups have had the time to pick up litter," says Lundie Spence, Sea Grant's marine education specialist.

But Spence cautions that not enough are aware of the problem. "A litter-free beach means that everyone on the beach 'picks it back'—takes it home," she says.

That's exactly why Jessie Bush of Nags Head joined the fight.

Bush, who describes herself as an environmentally concerned citizen, had been reading about wildlife entanglement in her magazines. She knew she lived in a popular tourist area and believed education might heighten awareness of marine debris and its effects on wildlife.

So she wrote letters, picked up trash, talked to people, wrote more letters and made calls.

Progress was slow, but one thing led to another.

In March, with the help of a local artist and the Dare County Board of Commissioners, an illustrated poster was published. It pleads, "Help Save Our Wildlife, Plastic Litter Kills."

Bush and her helpers distributed the posters in fish houses, restaurants, businesses, marinas, piers and homes.

"Reception has been remarkable," says artist Che Greenlee. "Since this is an emotional issue, this is something people can relate to."

Articles, radio announcements and speeches at local clubs brought the issue home. And already, plans are in the works for a 70-piece slide show at the N.C. Aquarium on Roanoke Island, public service announcements and another poster.

And Bush wants to involve state government in regulation and legislation of marine debris.

"Somehow the message has to get through," Bush says.

One person.

One goal.

One ocean.

S **BRUCE SMITH** R SANDSIFTER

By Sarah Friday

Bruce Smith isn't gifted with extra-sensory perception.

And he doesn't have a degree in sociology.

But the New York native can tell you more about East Coast beachgoers than anyone—without ever seeing them.

Smith cleans beaches for a living.

As the owner of Sandsifter, a beach maintenance operation based in Sea Cliff, N.Y., he's traveled from New Orleans to Portsmouth, Maine, in search of debris.

On the way he's found plenty of trash—plastic bags, light bulbs, candy wrappers, beer cans. You name it.

But he's also discovered that what he finds in the sand often tells a story and that it's easy to identify the cast of characters.

Smith sees North Carolina beachgoers as frequent smokers and soda drinkers.

In Florida, industry plays a larger part.

New Yorkers are picnickers, he says. Plenty of plastic forks, spoons, knives, plates, beer cans, empty soda bottles and Styrofoam cups give it away.

"Everybody there loves the beach," Smith says. But trash is just "one of those things nobody thinks about."

On any given summer day at Jones Park Beach on Long Island, tourists create 4,000 cubic yards of debris. That's the most in the world.

But Smith is the first to admit that the problem on the coast is worse than a few discarded fast food bags.

Oil sludge and ocean dumping leave tons of grease and gunk lying on the beaches. Eight and a half million pounds per year to be exact.

Tighter oil sludge restrictions in New York have cleaned up that problem, he says. But no laws prohibit dumping offshore.

Photo by Scott Taylor



Soda cans and trash pile up on Shackleford Banks

In his five years of business, Smith has seen debris take its toll on wildlife. He's found the decomposed carcasses of fish, sharks and seagulls. But the most striking changes he's seen were in the New York area. Where he once saw one dead gull a month in the harbor, now he sees one almost daily.

Florida faces the same problems.

Sludge, tourists, industrialization and shipping pile debris higher and higher, making the Sunshine State's beaches the dirtiest on the East Coast according to Smith.

"It's not that people in Florida are dirtier than New Yorkers; it's just that the prevailing weather patterns make it more of a problem," he adds.

Debris from the mainland collects in the canals and waterways and rushes to the ocean. Then, the Gulf Stream currents and winds from the east push the floating waste mixed with seaweed back onshore.

Smith attributes most of Florida's problem not to tourists, but to freighters offshore.

Food, boxes and trash often break loose from the ships or are thrown overboard. In one story Smith heard, 300 tons of frozen chickens slid into the sea.

In North Carolina, Smith has seen plenty of plastic plates, spoons and jugs—the kind orange drink comes in at the quick-stop shops.

But one of the biggest contributors to litter in North and South Carolina is cigarette butts. He's found so many in his harvester-like sandsifter that he's renamed the beaches "The World's Largest Ashtray."

"The biggest problem I see in North Carolina is the beaches tend to be rather narrow," he says. This creates two problems for beach cleaning.

The density of people and trash increases when the beach isn't very wide. And since the beaches are small, the sand tends to compact and is hard to sift.

Still, Smith ranks North Carolina's beaches as some of the cleanest he's seen on the East Coast.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



When lightning meets sand on North Carolina's beaches, a striking phenomenon takes place. Heat from the lightning fuses elements in the sand to form glass-like tubes called fulgurites.

"As lightning strikes the sand, the electricity runs to the groundwater," explains Lundie Spence, Sea Grant's marine education specialist. "The heat from the electricity actually melts the silica, which is one of the major components of sand in North Carolina's beaches."

Most sand in North Carolina is composed of two minerals—quartzite and feldspar. Quartzite contains the element silica, which is used to make glass.

Fulgurites are rare in the state, Spence says. But specimens can be found. They vary in size and are usually finger-like with smooth interiors and rough, sandy exteriors.

You can find fulgurites on high dunes after a rain. Spence suggests searching the dunes of Bear Island and Nags Head Woods.

The rain washes away loose sand, uncovering the fulgurites.

If you find one, dig it out carefully, Spence says. All fulgurites are collector's items, but larger specimens are more valuable.

To make room for new publications, Sea Grant is having a sale. In the coming months, we'll feature some of our popular booklets at reduced prices.

If you're a birdwatcher, you may want to order a series of books about colonial waterbirds. *Atlas of Colonial Waterbirds of North Carolina Estuaries* (UNC-SG-78-10) has been reduced from \$7 to \$5. And its 1983 supplement (UNC-SG-84-07) has been marked down from \$2 to \$1.

Management of Colonial Waterbirds: Summary Proceedings of a Workshop (UNC-SG-80-06) is reduced from \$2 to \$1.

To order, send a check to Sea Grant for the sale prices. Please specify the publication number.

Sea Grant is sponsoring a national technical conference on surimi, a minced fish product used in restructured seafoods.

Until recently most surimi was made from Alaska pollock. But Sea Grant researcher Tyre Lanier has proved that fatty fish, such as menhaden, are also acceptable in making surimi.

The conference, to be held in Raleigh Dec. 8 and 9, will examine the use of fatty fish in surimi. It will attract industry leaders and international experts in surimi research.

Write Sea Grant for more information on the conference.



Things are anything but dreary around the Great Dismal Swamp these days. The U.S. Fish and Wildlife Service recently unveiled a \$6.4 million plan for managing the huge refuge on the North Carolina-Virginia border.

The plan calls for protecting and preserving the wildlife and history that have been a part of this 106,000-acre refuge for more than 200 years.

In the late 1700s, George Washington attempted to drain the swamp and use the land for farming and logging.

And before the Civil War, the area was a refuge for as many as 1,000 runaway slaves.

From the 1920s to the 1940s, logging operations continued in the Dismal Swamp. Then in 1973, the Union

Camp Corp. turned over the land to the U.S. Department of the Interior.

Now, wildlife officials hope to bring back bald eagles and red-cockaded woodpeckers, restock the streams and maintain the populations of bears, bobcats, deer and more than 200 species of birds.

Plans also include forest regeneration and four new visitor centers.



The New Bern High School coastal biology class has published another best seller. Last year, we told you about *The Influence of Man's Existence*, a book about

the impact of man on the Trent and Neuse rivers. *Coastwatch* readers were so interested that the class received orders from all over the state and a few from as far away as Texas and Indiana.

This year 42 students worked together to produce *A Walk on the Wild Side: Croatan National Forest*. "Wilderness for wilderness' sake, for preservation, for wildlife and for man, that's what the Croatan National Forest is," the students write. "There is an unknown world on the east coast of North Carolina waiting to be discovered, with pathways of adventure to meet a wide variety of interests."

This 127-page book explores the wilderness of Croatan National Forest.

For a copy of the book, write New Bern Senior High School, in care of Coastal Biology, 2000 Clarendon Boulevard, New Bern, N.C. 28560. Enclose a check for \$7.50 made out to the New Bern Senior High School Coastal Biology Class.

Proceeds from sales will go for scholarships for the students.

Shellfish farming is one of coastal North Carolina's most productive aquaculture industries. Residents buy or lease submerged lands to grow clams, scallops or oysters.

Whether you're planting your first crop or your fifteenth, it's important to

Continued on next page

know the laws that regulate the cultivation and harvest of shellfish.

The booklet *Shellfishing—North Carolina's Aquaculture Regulations* outlines these rules and explains the requirements for meeting them. Written by Walter Clark, Sea Grant's coastal law specialist, the publication also provides a lease, license and permit requirement checklist for different species of shellfish.

For a copy, write Sea Grant and ask for UNC-SG-84-06. The cost is \$1.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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COAST WATCH

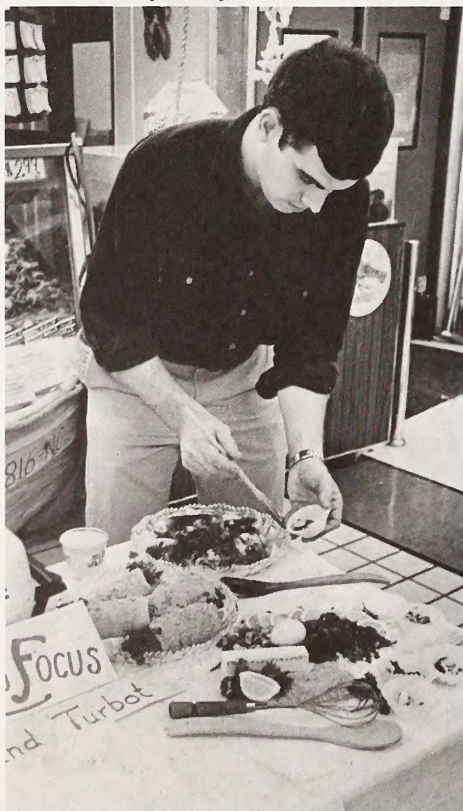


For seafood,
it's quality that counts

A fresh

Seafood Quality

Photo by Scott Taylor



Skip Kemp preparing a fresh catch

When the total on the cash register reads more for tuna or mackerel than it does for fillet mignon, you want the best.

That means a fish that looks good, smells good and above all tastes good.

You don't buy marginally fresh fish anymore.

You've read the magazines, food columns and cookbooks, and you've learned to sniff the catch and check behind the gills.

You, the almighty consumer, are demanding, not asking, for the same quality and freshness from your oysters and halibut as you do from your chicken, pork and beef.

Seafood distributors, retailers and restaurateurs are getting the message. And the government is listening too.

Congress has allocated \$400,000 to the National Marine Fisheries Service to explore options for fishery production inspection.

Unlike beef, pork and poultry, seafood is not continuously inspected by U.S. Department of Agriculture Food and Drug officials.

But Steve Otwell, Florida Sea Grant seafood specialist, says that doesn't mean seafood evades government scrutiny.

Seafood processors and retailers are subject to periodic inspection by county, state and federal agencies, he says.

And the National Marine Fisheries Service does conduct a voluntary inspection program. Processors pay to participate, and they receive a product grade.

Generally, Clark Calloway of Clark's Seafood Co. Inc. in Beaufort believes the quality of seafood has improved during the last five years. Retailers and distributors are demanding better quality fish and shellfish from their suppliers—fishermen and fish houses.

Calloway prefers to buy fish and shellfish that were iced immediately after being hauled from the water. He knows that an hour off ice will shorten the shelf life of any fish by days.

But fishermen don't always take the extra time or go to the expense to carry ice.

The reason?

Fish houses can't always pay them for their trouble.

Frequently market supplies, demands and prices prevent buyers from paying extra.

But some fish houses and processors add in a few extra cents for well-handled, properly iced seafood. And with everyone becoming more quality conscious, it may be a trend that is growing.

But quality goes beyond fishermen. Processors and distributors must take some responsibility, too.

Calloway says with the use of better and more refrigeration in

awareness

By Kathy Hart

processing plants and delivery trucks, suppliers are doing a better job of keeping the catch cool.

Even air transportation figures into the quality quotient.

Consumers are craving salmon from Alaska, crawfish from Louisiana and mussels from Maine.

Consequently, Calloway knows the airline schedules from Miami and Boston to Raleigh as well as he knows today's market price for shrimp and swordfish.

Air freighting allows distributors to transport fresh seafood across country in hours. The seafood is packed with gel refrigerants to ensure its freshness and quality.

No matter how seafood arrives at the grocery store or fish market, it's up to the retailer to be the final quality control checkpoint in seafood's path to the consumer.

"I check the gills, eyes and run my thumb up the scales of the fish," says Stephen Taylor of Jack's Seafood Market in Raleigh. "If the fish is gutted, I look at the blood in the body cavity to see how dried and dark it is.

"I send it back if it doesn't look fresh," Taylor says.

Gary Bass of Fishmonger's Seafood Market in Durham says he has rejected shipments, too. But to eliminate the problems of unacceptable products, Bass buys directly from fishermen and fish houses.

No middle-man distributors for him.

Bass sends a truck to coastal North Carolina once a week to pick up fish and shellfish. He says the extra effort is worth it.

"If I know that a fisherman has taken care of his catch, I have no trouble holding it for as long as a week before it's sold," Bass says. "Good fish that is properly refrigerated will hold a week."

Skip Kemp, Sea Grant's seafood marketing specialist, agrees. But he cautions that seafood must be kept between 30° F and 32° F.

And he suggests that retailers date their product. Then they'll know when their seafood is too old for sale.

At Jack's Seafood Market, Taylor keeps his tuna, mackerel and dolphin on ice.

He packs ice along the bottom of a display case that he keeps well drained.

Fillets are placed on perforated trays and covered with plastic wrap to keep them moist. Whole fish are laid directly on the ice bed.

By taking good care of his fish and shellfish, Taylor lets his customers know his commitment to quality and keeps them coming back.

"People are a lot smarter about buying seafood now," Taylor says. "They're looking for better quality. Prices are higher, and they want to get the most for their money."

Photo by Kathy Hart



Consumers are asking more questions about the catch

Follow your nose

When it comes to choosing seafood, it pays to be nosy. "If you can't do anything else when you're buying fish and shellfish, smell it," says Joyce Taylor, Sea Grant's seafood education specialist. "Your nose is always the best indicator of freshness."

If a retailer is hesitant to let you sniff his product, you should be hesitant to buy it, Taylor says.

"My philosophy is, 'If they don't want you to smell it, there's a reason for that, and you should go somewhere else for your seafood.'"

"In any ingredient, freshness is the most important thing," Taylor says. "You certainly wouldn't buy a steak with an off-color to it."

Taylor recommends buying seafood the day you plan to use it. And don't just toss it in the refrigerator. Keep it on ice.

If it's going to be several days before you cook it, Taylor recommends freezing to maintain quality.

To help consumers choose seafood, Taylor has written a brochure, "Hooked on Fresh Fish and Shellfish." The following tips are from that publication.

Fresh fish should have:

- eyes that are bright, clear and protruding. As a fish deteriorates, the eyes become cloudy, pink and sunken.
- gills that are bright red or pink and free from slime. Avoid fish with gills that are dull pink, gray, brown or green.
- flesh that is firm and elastic and springs back when pressed gently. As fish ages, the flesh becomes soft and slimy and slips away from the bone. The flesh of fillets should be firm and elastic and have a translucent, moist look.
- skin that is shiny and not faded, with scales that adhere tightly.
- an intestinal cavity that is pink with a bright red blood streak. The streak should not be dark or brown.
- an odor that is fresh and mild. Fish fresh from the water have no "fishy" smell.

Fresh shrimp have

- a mild odor and firm meat.

Cooked shrimp have

- red shells and meat with a red tint. They should have no disagreeable odor.

Live crabs and lobsters

- show movement of the legs. The tail of a lobster should curl under the body and not hang down when the lobster is picked up.

Cooked crabs and lobsters

- should have a bright red color and no disagreeable odor.

Clams and oysters in the shell

- should be alive. Shells should be tightly closed or should close tightly when tapped.

Shucked oysters

- should be plump with a natural creamy color and clear or slightly opalescent liquid. They should not contain more than 10 percent liquid, and should have a mild odor.

Fresh scallops

- have a sweet odor and are free of excess liquid. The meat of bay and calico scallops is typically creamy white but may be light tan or slightly pink. Sea scallop meat is typically creamy white but may be slightly orange or pink.

Frozen seafood

- should be solidly frozen with no discoloration or drying (freezer burn) on the flesh. It should be wrapped with moisture-proof and vapor-proof material that fits closely and is undamaged.

For more information on buying fresh seafood, write Sea Grant for a free copy of "Hooked on Fresh Fish and Shellfish." Ask for UNC-SG-85-08.

Lessons in handling

By Nancy Davis

A seafood dealer pulled a glistening bluefish from an ice-filled box and raised it high in the air.

"You can't find any better quality than this," he said.

He was right.

Earlier that day, a fisherman had caught several hundred pounds of bluefish off the coast of Cape Hatteras. As soon as the fish were netted, they were iced down in the boat's hold. Within a few hours, the fish were delivered to a dealer where they were rinsed and packed in fresh ice.

The next day, bluefish was featured on the menu of a Morehead City restaurant. And more than likely, it tasted as though it had just been pulled from the water.

"That fish had all the characteristics of what I think is quality," says David Green, Sea Grant's seafood extension specialist.

It was kept at the proper temperature, rushed to its destination and handled properly on the way, he says.

Such freshness is no accident. From the time seafood skims the water until it reaches your table, every step counts.

So before you take a bite, stop and think. Why does that fish or shrimp look, smell and taste the way it does?

Green and Sea Grant food scientist Frank Thomas say that seafood quality is determined by a variety of factors. Their story begins while the fish and shellfish are still in the water.

BIOLOGY. Even before seafood is harvested its quality has already been affected by biological factors.

At certain times of the year, a particular seafood may not be at its best, Green says. During spawning, for example, fish and shellfish may have watery, soft flesh that contains less fat and protein than at other times of the year.

The species size, sex, maturity and habitat also can affect its quality.

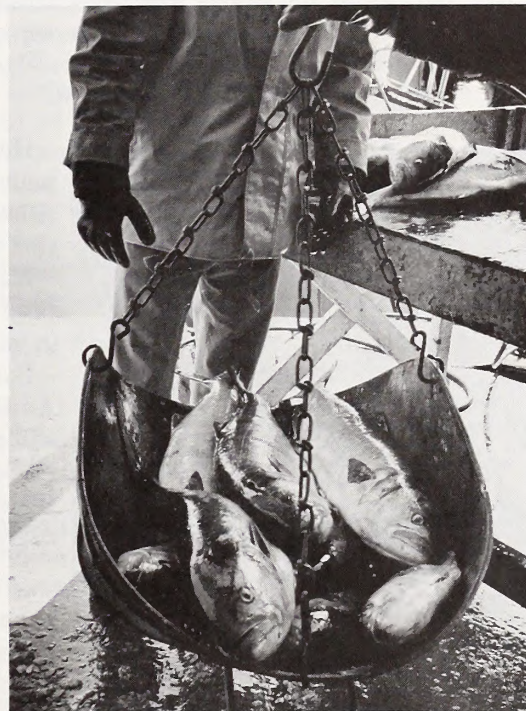


Photo by Scott Taylor



Photo by Scott Taylor

continued next page

Lessons in handling *continued*

HARVESTING METHODS. A quality control program begins with the fisherman, Thomas says.

Towing nets too long produces catches that are too large. As a result, the fish die before they're landed. The fish's flesh may be punctured and their bodies de-scaled.

"When dead, badly bruised or exhausted fish are landed, they will have a relatively short period of time in which they are considered fresh or in top quality," Green says.

Thomas adds, "You're degrading the product even before you bring it on board."

Photo by Scott Taylor



HANDLING. Seafood is at its freshest the moment it is pulled from the water, Green says. After that, it's up to the fisherman, the dealer, the processor and the retailer to see that the seafood retains as much of that quality as possible.

Exposure to sun, wind and high temperatures for even brief periods shortens the time in which seafoods remain in good quality.

Careless handling can shorten seafood's shelf life by days. And once the fish has begun to deteriorate, nothing you do will reverse that process.

"Seafood has a built-in memory," Thomas says. "Every time it's mishandled, it remembers. All these things are cumulative."

COMPOSITION. All foods have to be handled carefully, but seafoods require extra attention because of the delicate nature of the meat, Thomas says.

Notice how fish flakes when it's cooked. Fish lack the strong connective tissues found in the firmer flesh of red meats. As a result, fish are more susceptible to the rigors of handling than red meats.

For beef, a little natural deterioration is desirable, Green says, because it help tenderize the meat. But deterioration in seafoods usually produces an off-flavor.

TEMPERATURE. The special proteins in seafoods make them more susceptible to high temperatures than red meats, Green says.

For example, at a constant 32° F, some lean fish can remain fresh for up to 14 days. But raise the temperature one degree to 33° F, and the shelf life drops to only 11 days.

"If the temperature goes above 40, that fish isn't going to last long," Green says.

TIME. "When you get fresh fish, it ain't going to be fresh for long," says Wanchese seafood dealer Willie Etheridge III. "You gotta sell it because every day it's another day older."

At every step from the fisherman to your table, seafood should be moved as quickly as possible, Green says. If a dealer realizes there is no market for his product, he should freeze it immediately. But remember, freezing only locks in the quality that was present then. It doesn't improve quality.

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities — on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



The sun is out, the sand is hot, and you're headed for the surf. But before you dive in, heed this warning. Shallow-water dives can cause severe injuries.

In a study of diving accidents on California beaches, researchers found that injuries often occurred when swimmers jogged toward the water, then dived into a wave.

Their heads often struck the gently sloping sea floor or a sandbar. And the impact was sometimes enough to cause paralysis and even death.

Robert Osborne, a University of Southern California Sea Grant researcher, spent the last year analyzing the locations and frequencies of shallow-water diving accidents along Southern California beaches. He found that most victims are young males.

"Nine times out of 10, women will duck down and get themselves wet before walking further, up to their waist, to swim," Osborne says. "Teenage and adult males are more likely to enter the water by making shallow dives under oncoming waves."

To avoid injury, Osborne advises swimmers to walk into the surf until it is deep enough to swim. Never dive until you know how deep the water is, he says.

Hundreds of volunteers are hoping to make a clean sweep of North Carolina's beaches Sept. 19.

This coastwide cleanup, known as "Beach Sweep," will take place on our

inland and coastal shorelines. Volunteers will pick up marine debris at various sites, then record the amount and sources of plastics found.

"Beach Sweep" is being coordinated by UNC Sea Grant, the N.C. Division of Parks and Recreation and the N.C. Division of Coastal Management. Several coastal states such as Texas and Louisiana will conduct similar programs on this date as part of Coastweeks '87, a national celebration of coastal resources and heritage.

If you or your civic group would like to take part in North Carolina's beach cleanup, call Kathy Henderson of the Division of Coastal Management at 919/733-2293.



You've always dreamed of owning a place at the beach. But if you're not informed, your dream could become a nightmare. Erosion, flooding and hurricanes create added risks for coastal property owners.

Whether you're buying a vacant lot, cottage, condominium or time share, you could probably use some expert advice.

To help you through the maze of considerations, Sea Grant and the N.C. Real Estate Commission have published *Your Place at the Beach: A Buyer's Guide to Vacation Real Estate*.

The 28-page booklet addresses the environmental hazards, ownership options and costs associated with coastal real estate. And it can help you know what questions to ask sellers, real estate agents, government personnel and attorneys.

For a copy, write Sea Grant. The cost for postage and handling is \$1.

The North Carolina State University Industrial Extension Service is sponsoring a series of workshops on hazardous waste management.

The workshops will focus on the waste disposal problems of marinas, small boat manufacturers, vehicle ser-

vice facilities, educational institutions and hospitals.

Workshops will be held Sept. 9 in Elizabeth City at the College of the Albemarle and Sept. 10 in Manteo at the N.C. Aquarium.

For more information, write the Industrial Extension Service, NCSU, Box 7902, Raleigh, N.C. 27695-7902. Or call 919/737-2303.



Whether you own a 30-foot cabin cruiser or a 60-foot shrimp boat, a hurricane means trouble. Strong winds and rising waters can send a boat ricocheting off

other boats, docks or piers like a cue ball on a pool table.

Ultimately, the boat can be severely damaged or destroyed.

The North Carolina and South Carolina Sea Grant College Programs have put together two publications that can help recreational boaters and commercial fishermen ready their boats for hurricanes.

North Carolina Sea Grant has developed a 17-by-24 inch poster, *Hurricane Preparedness Checklist for Recreational Boaters*, that provides a pre-hurricane checklist of dos and don'ts for small-boat, large-boat and sailboat owners. It offers pointers on removing equipment, checking gear, securing the boat and more.

For a copy of this graphic poster, write North Carolina Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Enclose \$1 for postage and handling.

For information on protecting a commercial investment, send for South Carolina Sea Grant's new 16-page booklet, *Hurricane Preparedness for Commercial Fishing Vessels, Docks and Fish Houses*. It provides a step-by-step preparation guide and checklist for what to do as a hurricane approaches. And it offers suggestions for choosing a mooring location and preparing docks or fish houses for these ferocious storms.

Continued on next page

To receive a free copy, write Communications, South Carolina Sea Grant College Program, 287 Meeting St. Charleston, S.C. 29401.

Sea Grant has a limited supply of waterproof fishing maps for the waters around Roanoke Island and Oregon Inlet. The chart, which doubles as an attractive nautical place mat, includes Loran headings and is designed as a navigation aid to the area's prime fishing locations.

The cost is \$1 per chart. For your copy, write Sea Grant. Ask for the Roanoke Island fishing map.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, NC 27695-8605. Vol. 14, No. 7, August 1987. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday, staff writers.

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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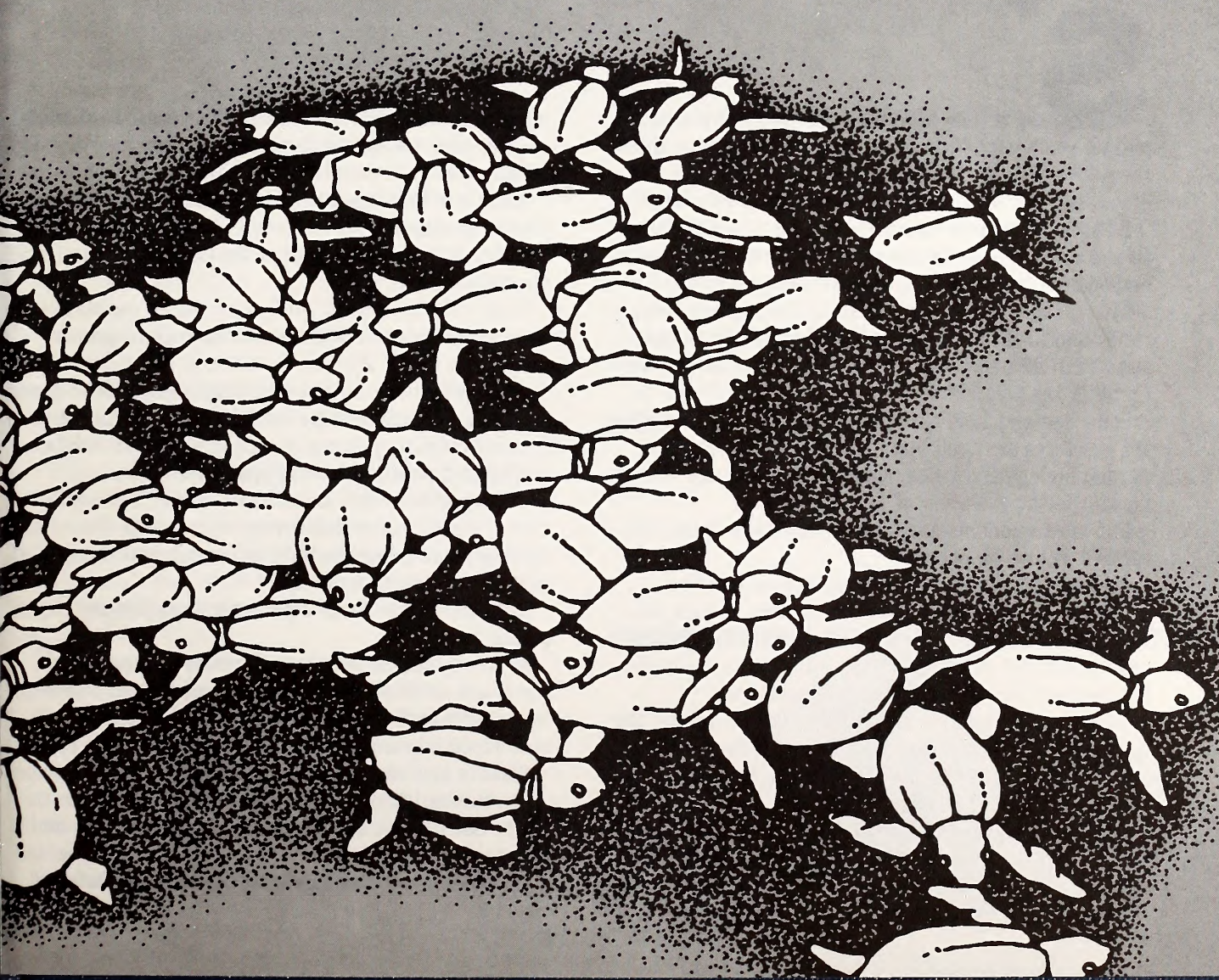
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COAST WATCH

THE TROUBLE WITH TURTLES





Surviv

Sea turtles have survived for more than 150 million years with little more than their shells to shield them. They have swum the oceans since the time of dinosaurs, outliving their reptilian cousins by centuries.

But now, sea turtles seem headed for a similar fate. Of the seven species in the world, six are considered endangered or threatened with extinction.

Five species—loggerhead, leatherback, green, Kemp's ridley and hawksbill—can be found in the Southeast. More than 99 percent of the nesting turtles in North Carolina are loggerheads.

Some theories hold that the populations of these giant sea creatures are declining naturally. Extinction is a normal biological process, some researchers say. It's important in the evolution of new species.

But most scientists and environmentalists blame the turtle's demise on people.

And now, they say the responsibility to halt the decline and to aid in the turtles' recovery is ours, too.

"Sea turtles have been a great success through time, until about 100 years ago," says Bill Brooks, naturalist for the Bald Head Island Nature Conservancy.

Excessive exploitation began then. People around the world captured sea turtles and their eggs for food, fisheries and trade. By the 1960s, more than 75 percent of the population had been eliminated.

Conservationists retaliated and the government took action. A ban was placed on turtle fishing, and in 1973, the Endangered Species Act made it illegal to

take or disturb adult turtles and their eggs. Worldwide, treaties were passed for further protection.

Still, sea turtle populations decline.

Many countries ignore the international treaties that protect the turtles, says Marydele Donnelly, director of the Sea Turtle Rescue Fund of the Center for Environmental Education.

From 1970 to 1986, 2 million hawksbill sea turtles were killed for their shells and sold in the Japanese market.

Olive ridleys are captured for their leather. And green turtles are slaughtered for leather, meat, oil and shells. In some countries, young hawksbill and green turtles, stuffed and polished, make popular souvenirs.

"The problem with international trade," Donnelly says, "is that the easiest turtles to catch are the nesting females because they're coming into shore. And that's the worst thing of all."

Killing a female turtle robs present and future populations.

In the United States, Donnelly cites the incidental catch and subsequent drowning of sea turtles in fishing nets as the reptile's biggest threat. Scientists estimate over 11,000 drown in nets each year. (See story, page 5)

Plastics and entanglements play a negative role, too.

Sea turtles often consume plastic bags and other trash. Such refuse can clog their digestive system and cause them to die.

David Webster, a researcher studying loggerheads at

By Sarah Friday

l of the Fittest

Sea Turtles Survived the Age of the Dinosaur . . . Can They Survive the Age of Man?

the University of North Carolina at Wilmington, believes increased development at the coast also has caused declines in populations.

Pollution, toxic waste, agricultural runoff and other environmental hazards alter turtle foraging grounds. And beachfront development destroys nesting habitats.

Brooks says the turtles aren't used to people, lights and activity.

"Developed beaches are seeing fewer and fewer turtles coming to their area," he says. "And natural beaches like Bald Head are seeing more and more."

Donnelly believes the turtles' problems may have broader implications.

"What is happening to turtles may be happening to other species," she says. "To me, it's an indicator of the health of the ocean . . . or the nonhealth."

Without these ancient reptiles, Webster fears nature would lose a vital cog in the cycles of marine ecology. There would be repercussions throughout the food chain, he says.

But today, conservationists are doing their part to ensure that those repercussions are never felt.

The CEE pushed the National Marine Fisheries Service to adopt regulations that will require shrimpers to equip their boats with turtle excluder devices. They've battled oil companies to stop the dynamiting of abandoned oil rigs in the Gulf of Mexico, a prime turtle habitat.

Internationally, the CEE and other environmental

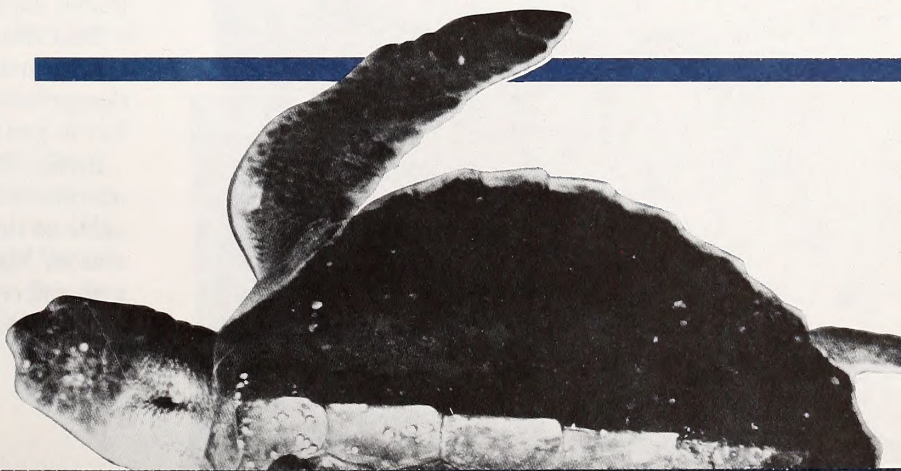
groups have worked feverishly to stop the trade in turtle products.

And the turtles have plenty of local support, too.

Florida plays host to 95 percent of the nation's nesting loggerheads and, now, to numerous organizations concerned about their survival.

Other states such as North Carolina, South Carolina and Georgia are helping also. Some of the most popular programs, like Bald Head's "Turtle Watch," monitor seasonal sea turtle nesting and hatching activities.

To Donnelly, this kind of local involvement is the solution to the sea turtles' plight.



By Sarah Friday

NIGHT WATCH

John Ward doesn't usually stay up until 4 a.m. But one Wednesday this July the Raleigh schoolteacher made an exception. The turtles were coming.

Ward was part of a small group of nature lovers that wanted to see the female loggerheads nesting on Bald Head Island. He had joined about 10 others for a four-day trip sponsored by the N.C. Museum of Natural History and the N.C. Nature Conservancy.

The first night of the watch, Ward was the only one awake when a mother sea turtle came to shore. By the second night, everyone wanted a chance.

But there were no guarantees.

Sighting a female loggerhead laying her eggs is rare.

Bill Brooks should know. Every night, the Bald Head naturalist and three summer interns patrolled the 12-mile beach looking for loggerheads. From 9:30 p.m. to daybreak, they rode three-wheeled vehicles up and down the beach like cowboys looking for a stray heifer.

Last season, there were 196 nests. This year the count was lower, running 65 behind the same time last year.

Some reassurance for the visitors came in discovering Bald Head is the state's largest nesting ground for loggerheads. Most sea turtles nest south of the island in more tropical environments, but loggerheads come to more temperate climates.

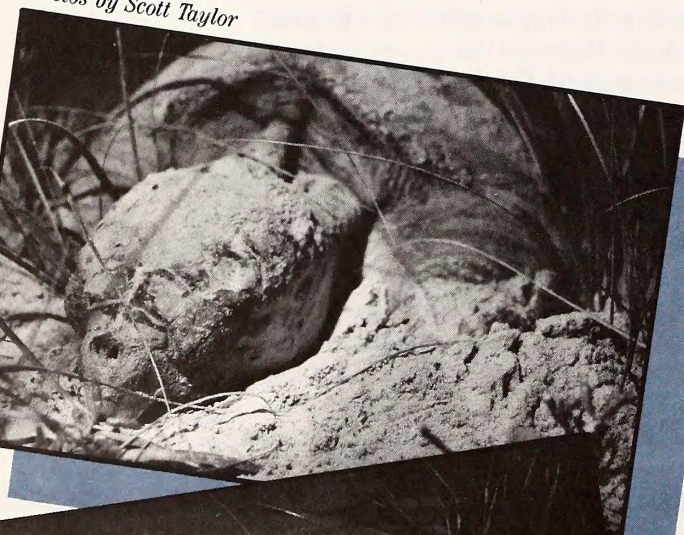
From mid-May to mid-August, they swim north, often running into the cape that juts from the island. Then they follow the shoals inland until they get to the beach.

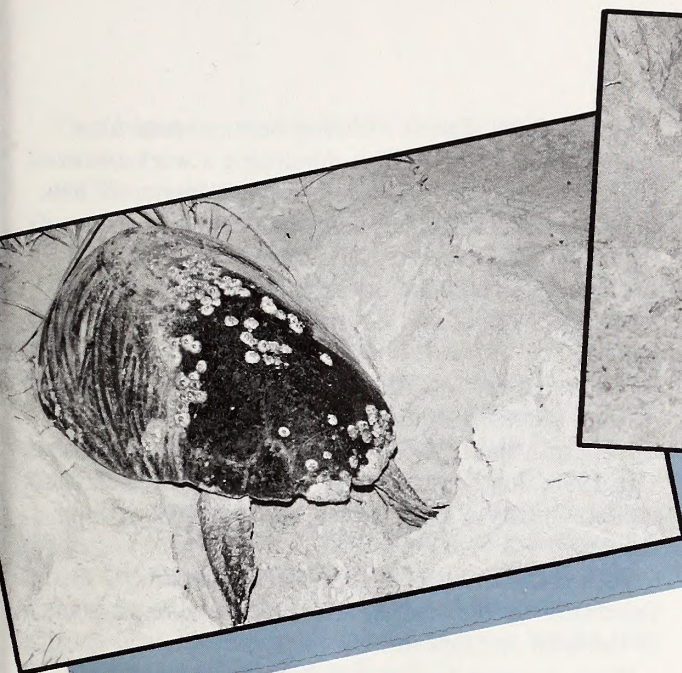
Bald Head remains relatively undeveloped and natural. A unique arrangement involving the developer, residents, the island's Nature Conservancy and government agencies has resulted in a major effort to protect the nesting loggerheads.

Brooks offers a nightly slide show and turtle walk to help educate visitors. And residents voluntarily turn off all outside lights so the loggerheads will not be distracted during nesting season. Nighttime beach walkers are asked to cover flashlights with red cellophane to reduce light interference.

Turtles are skittish creatures. Unusual sounds or lights will send

Photos by Scott Taylor





a mother turtle crawling back to the sea with no nest dug and no eggs laid.

Anticipation builds for the group as questions about the mysterious reptiles are asked and answered.

When night falls, the search begins.

About 9:45 p.m., Brooks takes one group to the darkest end of the island. Another heads in the opposite direction.

Both walk the beach for about an hour until it begins to rain, then head for the cottages.

About 11:45 p.m., somebody runs up from the beach with news.

They found a turtle about a half mile down on the right.

Some run; others walk.

Then, there—about 25 feet from the surf—they spot the female loggerhead laying her eggs.

She's about three feet long and probably weighs 300 pounds, one of the interns estimates. Her head is characteristically large, and her shell is gray and smooth except for some small barnacles.

Often these barnacles help Brooks and his staff identify the loggerheads when they nest on the beach again.

The mother turtle lies in a trance with her tail tilted downward. For now, she's oblivious to light, sound and people.

For more than 20 minutes she drops white, pingpong-ball-sized eggs into her nest. Sometimes three and four fall at a time.

Tears wet her eyes to protect them, and every now and then she sighs.

By the end, 150 eggs have filled the 1-by-2 foot hole.

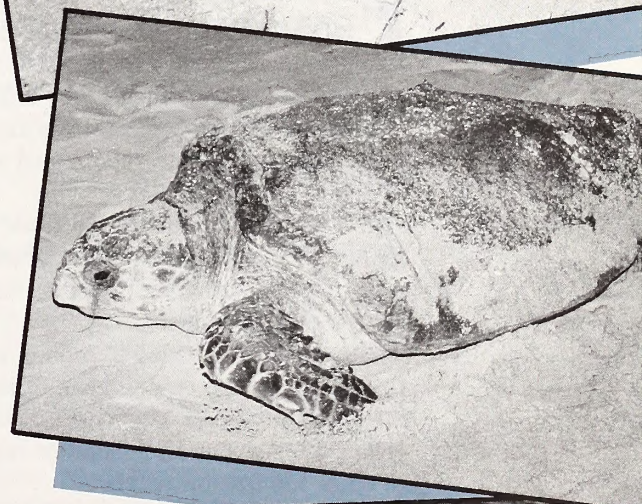
The turtle swishes sand into the cavity, then packs it down using her back flippers.

"Isn't she gracious," someone remarks as the loggerhead smooths over the nest with her "knees," or joints.

Then, to camouflage her nest from predators, she throws sand from the right and left for about 10 minutes. When she leaves her spot, even the interns cannot tell exactly where the nest was laid.

Slowly, the giant mother loggerhead pushes herself back through the sand to the ocean. She stops to rest, then waddles to the surf.

She waits for a wave to take her, then swims off into her dark home.

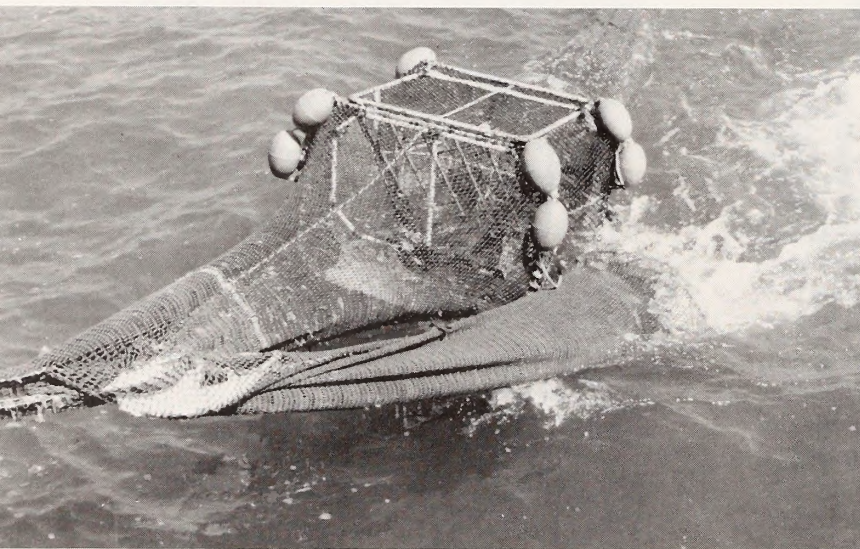


T · E · D

S P E L L S

C O N T R O V E R S Y

By Kathy Hart



From North Carolina to Texas, fishermen, environmentalists, and state and federal management agencies are butting heads over TEDs.

A TED is a turtle excluder device—an aluminum and web box that prevents endangered sea turtles from drowning in shrimp nets.

In a few months, many Southeast fishermen will be required to install TEDs in their nets. It's a requirement that has fishermen hopping mad and environmental groups cheering.

The devices, intended to protect turtles, have pitted fishermen against environmentalists. And each group has its own support cast—congressmen, federal agencies, state agencies and fisheries organizations—willing to enter the fray on its behalf.

The National Marine Fisheries Service spent nine years and over \$3.5 million developing a workable excluder device that could be sewn into fishermen's nets to eject turtles and small fish while catching shrimp.

For the last four years, NMFS gear experts asked shrimpers to install and use the TEDs on a voluntary basis. But more often than not, the requests were ignored.

Fishermen say the TEDs will reduce their catches of shrimp, the most sought-after and valuable species on the South Atlantic and Gulf coasts.

In 1986, Southeastern fishermen netted over 325 million pounds of shrimp valued at over \$600 million dollars.

With competition keen from foreign imports, fishermen say they can ill afford to lose a single pound of the tasty crustaceans.

When it comes to money, fishermen also point to the cost of installing TEDs. The NMFS TED costs about \$350. Most North Carolina shrimpers pull two nets; some, four. And they'll need a spare. The overall cost could be \$1,000 to \$2,000 per shrimper.

And the shrimpers worry that the 2½-by-4 foot excluder devices will injure crewmen as they swing on and off the deck. To a fishermen, injuries translate to added dollars for already escalating insurance costs.

Some fishermen and fishery organizations go so far as to say the TED could put them out of business.

But NMFS officials don't think so. They have tried to counter the fishermen's concerns.

They told them of data from thousands of hours of tests that showed TEDs did not detract from shrimp catches or cause injuries.

But the wary fishermen remained largely unconvinced.

To them, TEDs were another government intervention, another device for making a tough job even harder.

But NMFS had a job to do, too.

Along with the U.S. Fish and Wildlife Service, NMFS was bound by law to uphold the Endangered Species Act that prohibits the capture of turtles.

And turtles were being captured, though unintentionally, in shrimpers' trawl nets.

NMFS specialists estimate that more than 45,000 sea turtles are caught in shrimp trawls each year. Of those, more than 11,000 drown.

Environmentalists saw the statistics as a red flag.



They began to pressure NMFS, even threaten a lawsuit.

NMFS had developed a workable TED. Why weren't shrimpers being forced to use it, environmental groups asked.

And NMFS officials realized the futility of the volunteer TED program. Not enough shrimpers were using TEDs to reduce turtle mortality.

The time for mandatory use seemed at hand.

In early 1987, NMFS established proposed TED regulations and solicited public reaction. In late June, final TED rules were written.

Specifically, the regulations require shrimp trawlers 25 feet or longer to use TEDs in offshore waters from North Carolina to Texas. For vessels less than 25 feet long shrimping in offshore waters and for all inshore shrimp boats, the captains must limit their towing time to 90 minutes unless they pull a TED.

Restricting the tow times will limit the amount of time the net tows along the bottom to 60 to 75 minutes. And studies show that turtle mortalities are negligible at tow times up to 75 minutes.

Four types of TEDs were approved for use. They are the NMFS version, the more oval Cameron TED and two deflector grids, the Matagorda and Georgia TEDs. Other versions of the TED may receive approval if they are tested and prove to exclude 97 percent of the turtles captured.

The regulations become effective in Cape Canaveral in October. But North Carolina shrimpers have until May 1, 1988, to comply. The TED "season" will extend from May 1 to Aug. 31 in Tar Heel waters.

The U.S. Coast Guard, NMFS and the U.S. Fish and Wildlife Service will be responsible for enforcing the regulations. The N.C. Division of Marine Fisheries will provide no enforcement unless the rules are adopted by the N.C. Marine Fisheries Commission.

But the struggle to get TEDs on shrimping vessels didn't end with adoption of this federal regulation.

Fisheries agencies and organizations, and congressmen are lining up to take some of the wind out of the TED rules.

One of the first in line is North Carolina's Division of Marine Fisheries.

DMF opposes the regulations, especially the limitations on inshore shrimping. And the management agency is putting together a petition to sue NMFS, says DMF Director William Hogarth.

Hogarth maintains that the regulations are based on insufficient evidence.

He counters with his own data which show that 88 percent of the sea turtle strandings in North Carolina are reported on ocean beaches. But only 14 percent of the state's shrimp is harvested from the ocean.

In contrast, 8 percent of the strandings came from Bogue, Core and Pamlico sounds where 70 percent of the state's shrimp are harvested.

"We're not fighting the protection of sea turtles," Hogarth says. "We simply believe that shrimp fishermen were singled out without the data to back up the regulation."

Hogarth also believes that federal officials misled DMF. During talks about proposed TED regulations, NMFS indicated the rules would not include inshore waters or offshore waters north of Ocracoke, he says.

But the final ruling on the regulations did include these areas.

And U.S. Rep. Walter B. Jones is riled.

He is planning to introduce legislation in Congress that would amend the Endangered Species Act, says staff member and Sea Grant intern Danny Rasch.

The bill would place a one- to two-year moratorium on TED use in inshore waters in the Southeast and would require NMFS to conduct further TED tests.

Jones is likely to have plenty of support from his fellow Southeastern congressmen and senators. Like others, Jones believes that there is no data to substantiate the inshore regulations, Rasch says.

Chuck Oravetz, chief of NMFS's protected species management branch, admits that NMFS's inshore data is limited. But he says that's why NMFS restricted towing times and did not require TEDs.

"There are turtles there and they are captured by shrimp trawls," he says.

Oravetz also points out some of the feedback NMFS received from North Carolina during the public comment period for the proposed regulations (which did not include inshore waters) requested tougher regulations.

In particular, he cites a letter from the N.C. Wildlife Resources Commission. The commission manages and protects sea turtles during the terrestrial portion of their lives.

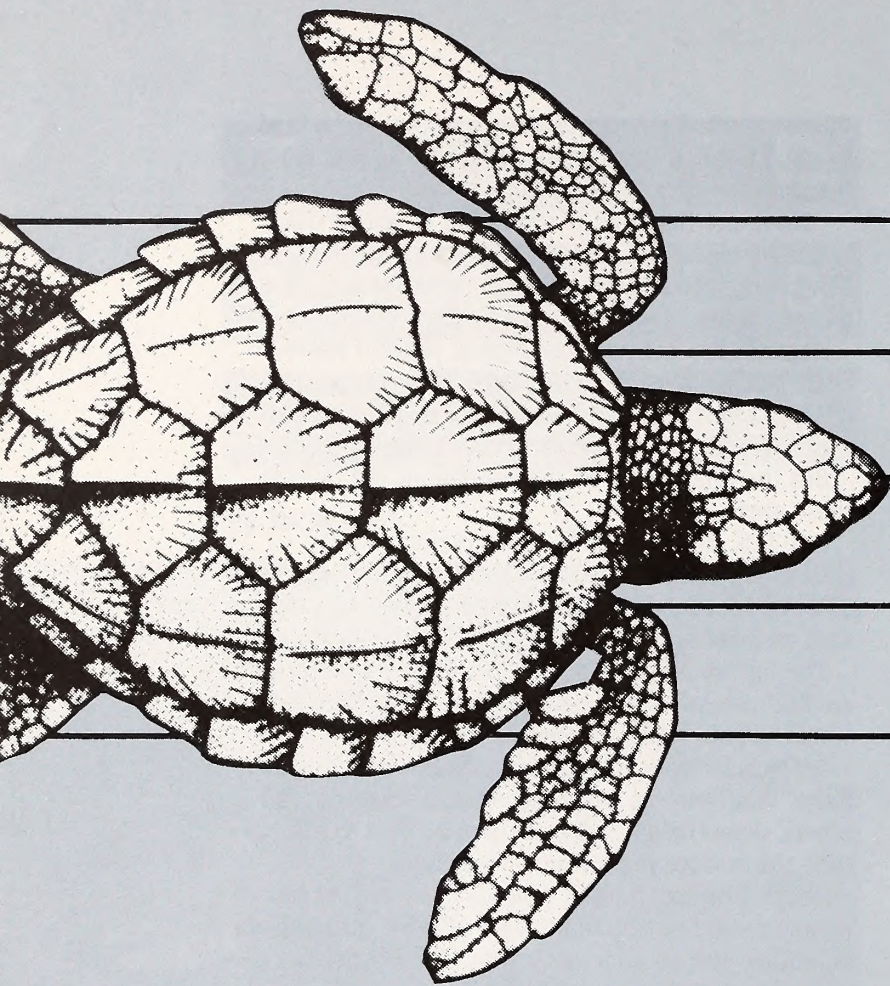
In an April letter, Charles Fulwood, executive director of the wildlife commission, supported the use of TEDs in offshore waters and recommended that the estuarine waters be included in the regulation.

"It was interesting," Oravetz says. "We were receiving opposing views from the same state agency." (DMF and the wildlife commission are both part of N.C. Department of Natural Resources and Community Development.)

But other states were sending mixed messages, too.

It was a matter of whether an agency or organization represented the fishermen's interests or the turtles' interest, Oravetz says.

Continued on page 9



A LESSON IN TEDs

By Kathy Hart

At the docks in New Hanover and Brunswick counties, Jim Bahen is teaching fishermen about an unpopular subject—TEDs.

For Bahen, a Sea Grant Marine Advisory Service fisheries agent, the classroom is the docks and his visual aid is an odd mixture of aluminum tubing and web.

Like other Sea Grant agents in the Southeast, Bahen is educating fishermen about the excluders.

He stops by fish houses on the days or afternoons when the “boys” are at the docks, pulls the collapsible TED from the back of his red truck and heads cautiously for the fish house door.

Sometimes he’s greeted warmly, and fishermen stop to listen.

Other times, he’s told to take his contraption and leave.

But gradually Bahen has coaxed one shrimper and then another to try the TEDs.

His main selling point is not the device’s ability to rid nets of turtles. North Carolina shrimpers claim they don’t catch many turtles and the ones they do catch, they revive.

Instead, Bahen gets fishermen to try TEDs based on the small fish, crabs and jellyballs they eliminate.

Shrimper William Varnum of Holden Beach has been pulling TEDs in his nets for three years.

“There’ll be a bunch of us out shrimping and we’ll come across an area where we’re catching a lot of fish,” Varnum says. “The other boats will have to leave and go to another area where the fish are not so bad. I keep right on going.

“I can put a few bugs (shrimp) in the hole like that,” he says.

Varnum says most fishermen do not want to pull the TEDs because they’re worried about losing shrimp and about injury to crewmen.

But Varnum says he catches the same amount of shrimp or more when the TEDs are in his nets.

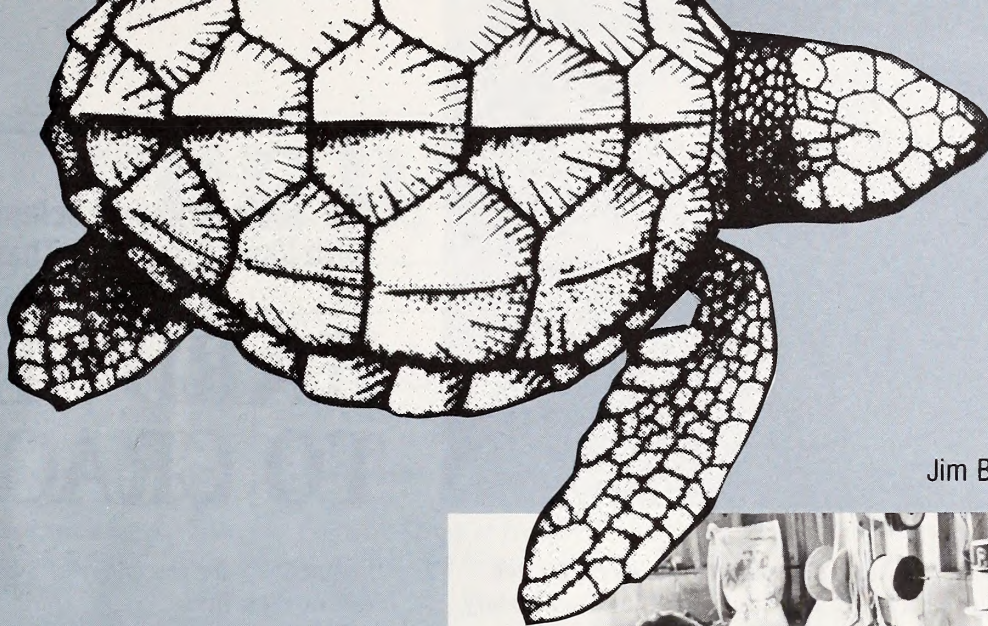
He’s convinced the TEDs save him time and money.

During July and early August, the fish bycatch was so heavy off Brunswick County beaches that fishermen split their nets to eliminate bycatch.

“Fishermen complain that they’re going to lose shrimp with TEDs,” Varnum says. “But you can’t tell me they don’t lose shrimp when they split their bags, too.”

And Varnum says the devices are no more dangerous than other equipment on the boat’s deck.

“The only time the TED is anywhere near the men is when you whip the nets in,” Varnum says. “You have to watch when you drop it to see how the boat is rolling. But if your men have common sense, there should be no problem.”



Jim Bahen and Steve Parrish



Varnum is one of Bahen's best students.

Others weren't as easily convinced. Even the promise of a free TED couldn't lure them to try the excluders. So Bahen tried another approach.

He began working with Supply netmaker Steve Parrish to redesign the TED.

Parrish was a willing partner. He didn't want to produce the TED designed by the National Marine Fisheries Service.

"Fishermen think that netmakers like the TEDs because we can make a killing off it," Parrish says. "That's not the way we feel. It's a hindrance to us too."

To build the NMFS TED, Parrish says he would have to hire extra personnel and buy new equipment.

He would like to find an excluder that is cheaper, easier and faster to build.

Bahen began telling Parrish about a "soft" TED made from webbing. It had been developed in South Carolina.

The two put their heads together and came up with a TED made of 8-inch stretch mesh.

A piece of mesh is sewn in the net at an angle. When the turtle hits the mesh, it is propelled downward and out of a slit in the bottom.

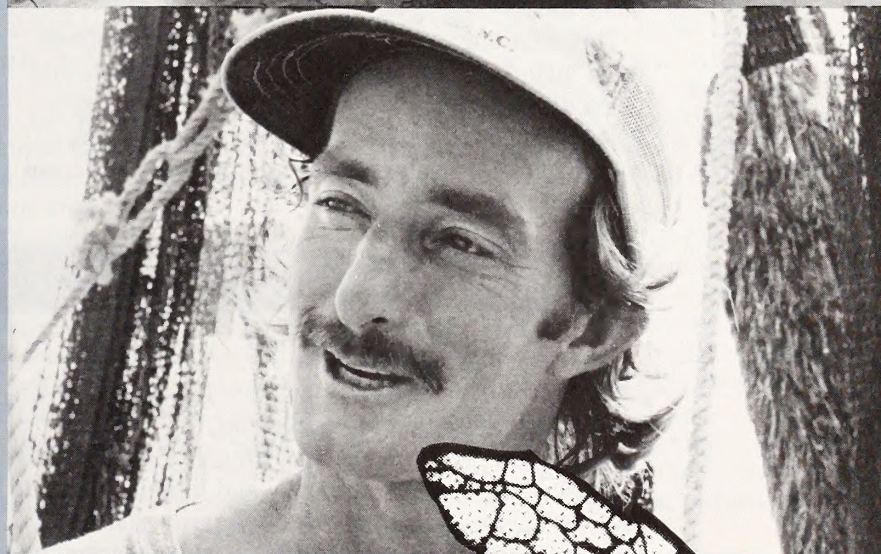
The slit is kept closed with an elastic bungee cord. It provides the flexibility to allow large objects such as turtles and jellyballs to escape but otherwise keeps the flap closed and the shrimp in.

Bahen and Parrish are testing their TED on Varnum's boat. If all goes well, the pair plan to ask NMFS to qualify their soft TED for use.

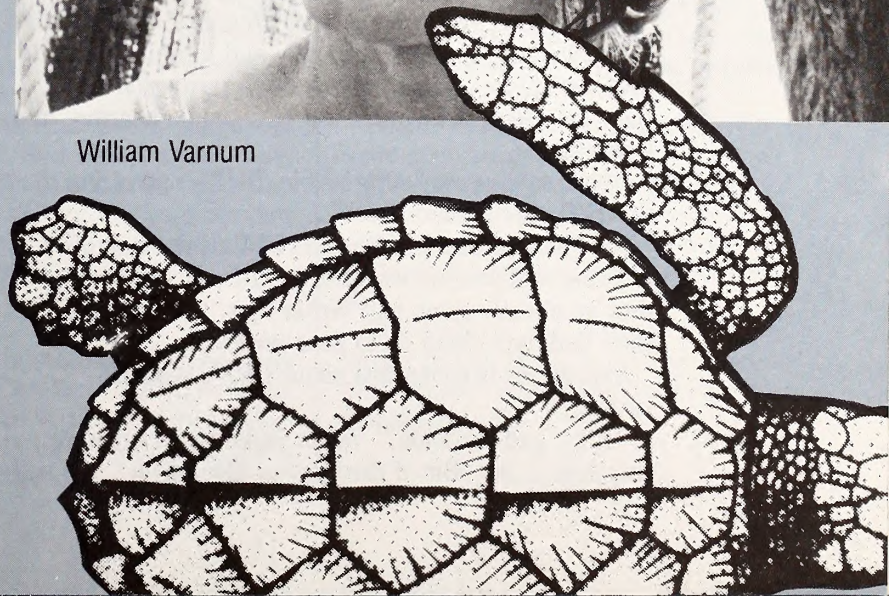
Even skeptics like shrimper Ronnie Galloway of Supply say the soft TED may offer the best solution for all sides in the TED controversy.

It reduces TED costs, eliminates safety concerns, rids the nets of turtles and, best of all, catches shrimp.

And if Bahen can convince Galloway to use a TED, he knows he has a good lesson plan.



William Varnum



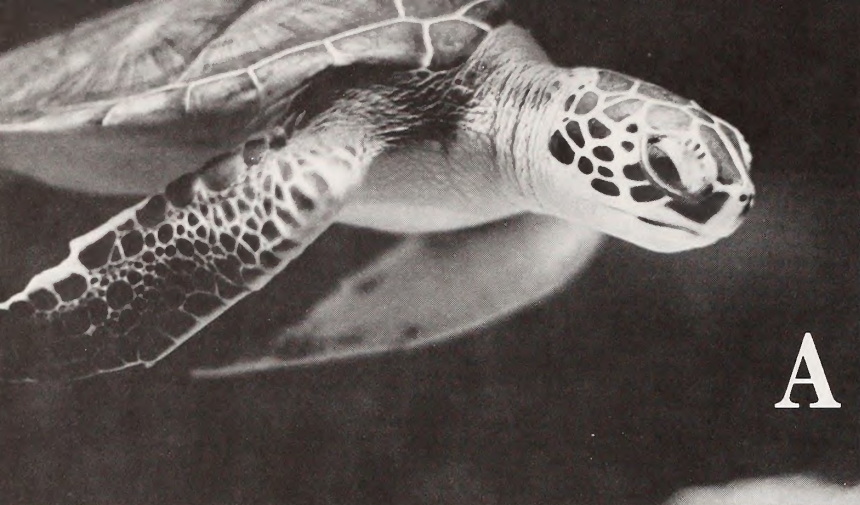


Photo by Norman Martin

By Sarah Friday

**Sea Turtles Provide Scientists
With More Questions Than Answers**

A HARD SHELL TO CRACK

The sea turtle has been roaming the globe for centuries. But for a creature with such an ancient history, it remains an enigma.

For the most part, scientists know only about the terrestrial portion of the turtles' lives—a small fraction of their lifetime.

For males, this time is limited to development in the egg, hatching and a short trek across the beach to the ocean. But females return to land more frequently to lay their eggs.

When female sea turtles reach reproductive maturity (about 20 to 25 years), they nest onshore three or four times a season. Some theories suggest they always return to their beaches where they were born, using olfaction, sand temperatures or water composition to guide them.

They nest only at night and use the moon to direct them inland. When a female finds an appropriate site below the vegetation line or near a dune, she digs a hole, lays about 120 eggs, then swims back to sea.

In 90 days, hatchlings crawl from the nest and head

instinctively for the water in which they'll spend the rest of their lives.

But the odds are against them. Only 1 percent of the hatchlings from each nest reach maturity.

Once the turtles are in the water, the mystery begins. Scientists find it nearly impossible to keep track of the large reptiles.

Most efforts to tag turtles have been unsuccessful. Small tags break or fall off. Tagging by satellite is costly.

In addition, research is hindered by the turtle's lengthy life span. Most sea turtles live to be 100 years old or older, making it impossible for one researcher to follow a full life cycle.

Studying an endangered species creates problems, too. Population numbers are low. Special restrictions for testing exist. And the work is expensive.

But scientists persist. They know a better understanding of this unique creature will help improve conservation strategies.

CONTROVERSY

Continued from page 6

Clearly on the side of the turtles is the Center for Environmental Education in Washington, D.C.

Mike Weber, vice president for programs for CEE, says his agency has worked nationally and internationally to save the ancient, but threatened sea turtle. Part of their involvement included the TED public hearings and negotiations.

Weber said he was surprised by DMF's opposition to the TED regulations.

"We believe that the Division of Marine Fisheries is twisting available information to suit conclusions they've already come to," Weber says. "I don't think their data will stand up to peer review."

And Weber is concerned about DMF's possible lawsuit.

"It's a bad situation," Weber laments. "I hope we can work it out. But if they pursue this lawsuit, we will

file a counter lawsuit. And in that suit we will ask that TEDs be required in all waters."

As representative organizations toss points and counterpoints back and forth about the TED, the time for its mandatory use approaches.

North Carolina shrimpers have eight months leeway. But faced with the inevitable, the fishermen are making phone calls and asking Sea Grant's marine advisory agents about the excluder devices.

In Brunswick County, Jim Bahen, a Sea Grant advisory agent, has distributed 42 free TEDs from NMFS.

The fishermen are installing the TEDs and getting accustomed to the way they pull in the water, Bahen says.

"Once they put the doggone thing on, they're going to find it's not as bad as they think it is," Oravetz says. "It's not going to put the shrimping industry out of business."

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, NCSU, Box 8605, Raleigh, N.C. 27695-8605.



This fall, why not combine a short beach vacation with education? Join Sea Grant, the N.C. Wildlife Federation and the N.C. Aquarium at Pine Knoll Shores Oct. 1 to 4 for a conservation retreat.

The weekend event will offer a chance to learn about the natural history of the state's barrier islands. Choose from classes such as barrier island folklore, seafood preparation and cooking, outdoor photography, marsh ecology, and seashell identification.

The retreat will be headquartered at the John Yancey Motor Inn on Pine Knoll Shores, and most classes will be held at the N.C. Aquarium. Participants will arrive on Thursday night, and classes will be held Friday and Saturday.

For more information, write the N.C. Wildlife Federation, Box 10626, Raleigh, N.C. 27605. Or call 919/833-1923.

As the first cool breezes of fall blow over coastal waters, schools of "blues," trout and mullet begin to migrate, or "run" as coastal folks say.

It's a perfect time to have a gill net set and waiting.

Sea Grant can help you prepare your net with its publication, *How to Hang a Gill Net*.

The booklet provides a step-by-step description for buying the supplies and hanging the net.

The versatile net can be used to catch a variety of fish—trout, hake and mackerel to name a few. And it can easily be staked, anchored, allowed to drift or pulled by a boat.

Aptly named, the gill net actually gills fish. The meshes are large enough to allow a fish's head, but not the rest of its body, to pass. When the fish tries to back out of the net, it gets caught behind the gill covers.

For a free copy of *How to Hang a Gill Net*, write Sea Grant. Ask for UNC-SG-79-03.



Sea Grant agent Bob Hines is getting the "hang" of putting offshore obstructions on computer. Hines is updating a list of inshore and offshore Atlantic hangs

and obstructions.

He recently traveled to the Alabama Sea Grant Program to observe how agents there put a similar list on computer. The hang log includes the Loran coordinates of wrecks, vessels and other structures buried in the Gulf.

Gulf fishermen can request the entire list, or they can have agents print out a list of hangs for a specific area.

Hines wants to develop a similar system for Atlantic hangs. He knows a hang can cost a fisherman hundreds of dollars in torn or lost nets.

And the obstructions often make excellent sportfishing and diving locations.

If you have hangs you'd like to contribute to Hines, write him at P.O. Box 896, Atlantic Beach, N.C. 28512. Or call 919/247-4007.

Or if you'd like a copy of Sea Grant's *Hangs and Obstructions to Trawl Fishing Along the Atlantic Coast of the United States*, send \$2 to Sea Grant. Ask for publication number UNC-SG-83-01.

For more information on Alabama's hang log, call Sea Grant agent Tony Lowery at 205/661-5004. Or write him at Alabama Sea Grant Advisory Service, 3940 Government Boulevard, Suite 5, Mobile, Ala. 36609.

Celebrate the state's seafood heritage at the North Carolina Seafood Festival. From Oct. 1 to 4, the Morehead City waterfront will be transformed into a showcase for the catch of Carolina.

The four-day extravaganza will include sporting events, educational exhibits, musicians, dancers, fireworks, a boat parade and more. For seafood lovers looking for a real taste of the festivities, the highlight will be a seafood sampling tent.

Sea Grant will present a series of seminars on topics such as seafood and health.

The festival has been organized by a group of volunteer citizens and businessmen from Carteret County. It is designed to promote the state's seafood catch and educate people about the importance of the resource to the state's economy.

For more information about the first North Carolina Seafood Festival, contact Carolyn Barnett at 919/726-1212.



Wayne Wescott is trying to interest the blue crabs in Roanoke Sound in a new meal with an artificial flavor. Wescott, a Sea Grant marine advisory agent, is testing

several formulas of an artificial crab bait developed by Du Pont.

The company has successfully developed an artificial bait for crawfish and is hoping to do the same for crabs. It is a mixture of polymers and fish meal.

The bait was formulated to attract the feisty scavengers and to last in the crab pot for up to one week. If it works, the 3-inch long, 2½-inch diameter bait logs could decrease the amount of labor and, perhaps some of the expense, required for crab potting.

So far, Wescott's test results have not been promising.

He's tried several different artificial bait formulas, but none have lasted a full week. And the catch ratios were down 50 percent compared to pots baited with fish.

But Wescott has several more formulas to try. He'll be testing those in September. Watch "The Back Page" for further results.

Continued on next page

The N.C. Natural Heritage Foundation has published a guide to many of the state's outstanding natural areas. A *Directory to North Carolina's Natural Areas* describes 108 locations from the mountains to the barrier islands that are accessible to visitors.

The 98-page booklet describes state parks, state wildlife gamelands, estuarine reserves, national parks and forests, as well as preserves owned by private conservation groups.

For a copy of the directory, write the N.C. Natural Heritage Foundation, P.O. Box 11105, Raleigh, N.C. 27604. The cost is \$5.



Sea Grant has a guide to some of the state's best offshore fishing spots, and strangely enough the guide is called *The Hardbottom Distribution Map*.

"Hardbottoms" is a geologic term for underwater mesas. These mesas and their jagged edges form natural reefs that attract some of the ocean's most delectable fare—

snapper, grouper and black bass.

The hardbottoms in Onslow Bay—an area between Cape Lookout and Cape Fear—are pinpointed on a map. Using the map's Loran grid, fishermen can locate the reefs.

Offshore fishermen say the maps will take much of the guesswork out of snapper and grouper fishing in Onslow Bay.

The flip side of the 39-by-27 inch poster features five attractive, four-color paintings of the underwater reefs and the flora and fauna they attract.

This side of the poster makes an excellent educational tool for teachers and students. The realistic paintings can provide endless classroom discussion of offshore geology, underwater habitats and species identification.

The poster costs \$5. For a copy, write Sea Grant. Ask for UNC-SG-86-25.

The 1987 Marine Expo will be held Sept. 27 to Oct. 4 in Wilmington, N.C. The weeklong event, held in conjunction with Wilmington's Riverfest, features a series of events focusing on marine

resources, educational opportunities, and the potential for future development.

This year underwater explorer Sylvia Earl will deliver the keynote address Tues., Sept. 29. And Emory Kristof, *National Geographic* underwater photographer, will present some of his work Oct. 1.

Staff from Sea Grant and other marine scientists will present some of the educational seminars for the expo.

For more information about Marine Expo '87, call 800/922-7117 in North Carolina or 800/222-4757 in the eastern United States.

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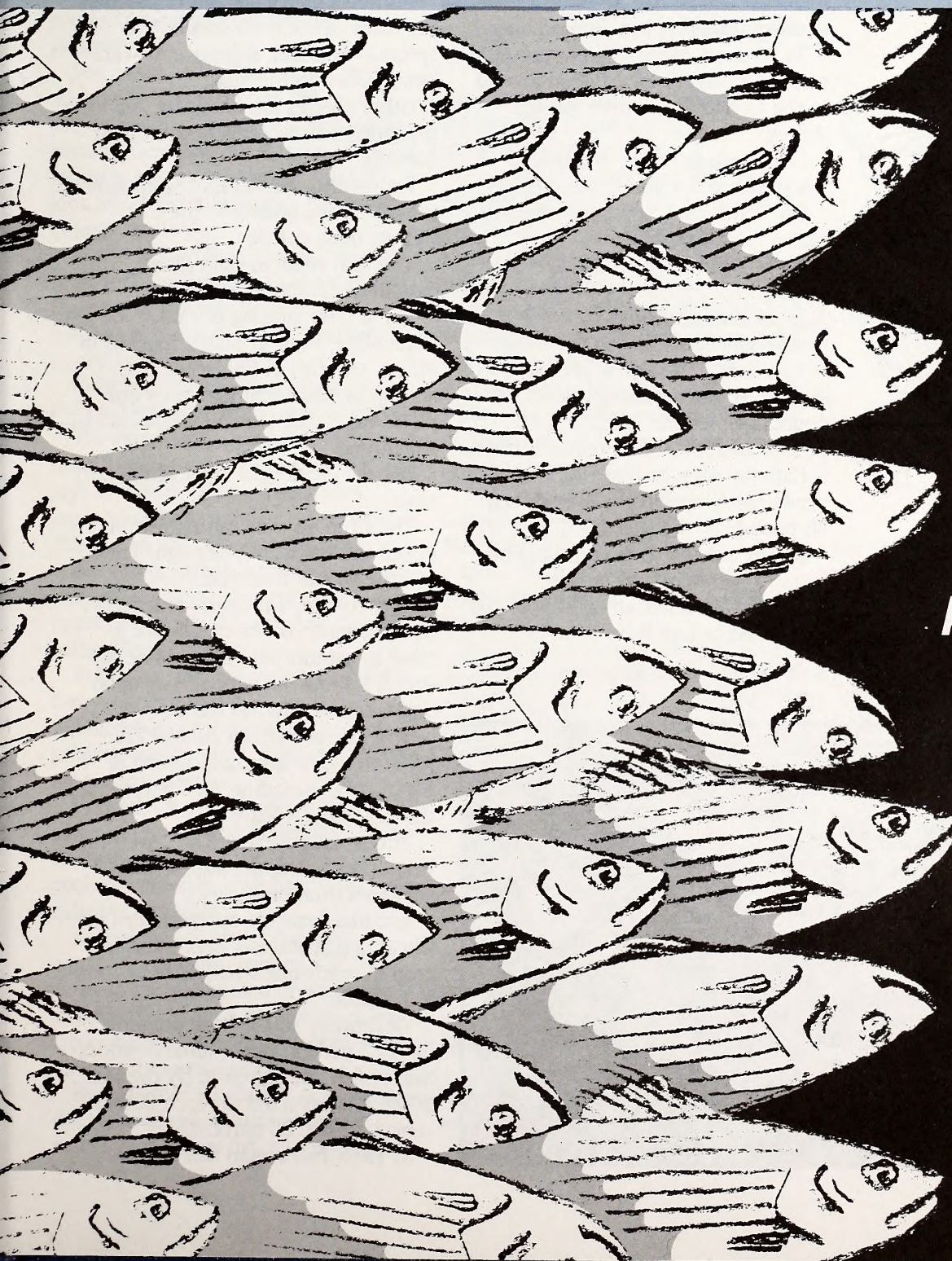
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COAST WATCH



AQUACULTURE
The Catch
of Tomorrow

farm-raised fish: a growing part of the nation's seafood production

By Kathy Hart

To meet America's growing hunger for seafood last year, the United States imported almost half of the fish and shellfish dished up on dinner plates.

To be exact, three billion pounds of seafood valued at \$4.8 billion arrived in the United States from foreign shores.

U.S. landings of ocean edibles amounted to 3.4 billion pounds.

But Americans' appetites have just begun to be whetted.

Every day, another medical study, magazine article or disease prevention organization extols the virtues and health benefits of fish and shellfish.

As a result, the public is dining on seafood at an increasing rate—13.6 pounds per person in 1984, 14.5 pounds in 1985, 14.7 pounds in 1986.

Experts estimate that U.S. per capita consumption could approach 46 pounds by the year 2000.

But to increase U.S. consumption by just one pound per person, fishermen must net an additional 700 million pounds of fish.

Seafood is showing up more often on American tables

The U.S. catch of wild fishery stocks cannot keep pace with the demand.

Fisheries managers and researchers say many of the most sought-after species—flounder, shrimp, crab—are being fished to the limit.

Other species are declining due to problems with or reductions in their habitats.

Economists predict that seafood imports will rise, adding to the U.S. foreign trade deficit.

The only relief in sight is the fledgling industry of aquaculture.

Yes, it's the farming of catfish in Mississippi, trout in Idaho, mussels in Maine, crawfish in Louisiana and shrimp in Texas that may keep our plates brimming and our bellies full in the future.

But the concept of aquaculture isn't new.

The Chinese were raising fish in ponds thousands of years ago. They saw the virtues it offered.

Aquaculture, if properly practiced, removes much of the guesswork it takes to capture wild fishery stocks. And it lessens the dependency upon unpredictable Mother Nature.

The fish farmer can control the location, abundance and timing of harvests by managing the life cycle of the fish and shellfish.

The aquatic creatures are given the best. They're fed, monitored and sheltered from predators.

Just like farmers who raise corn or wheat, aquaculturists want their fishy crop to reach marketable size as soon as possible.

Worldwide, aquaculture accounts for 12.2 percent of the annual production of fish and shellfish. By the year 2000, it is expected to reach 20 percent; by 2010, 25 percent.

In 1986, Norwegian fish farmers

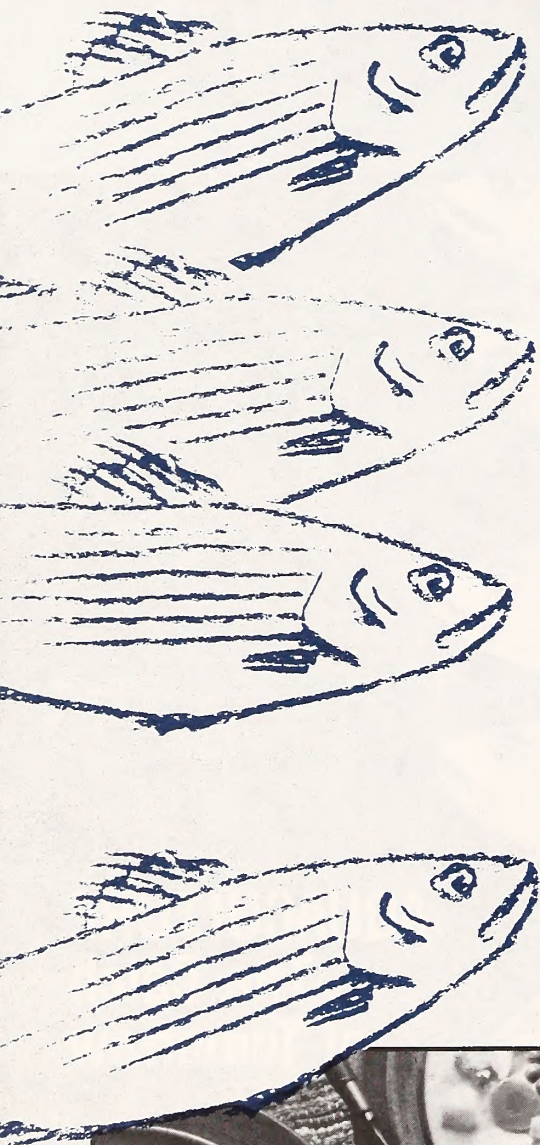


Photo from National Fisheries Institute



part luction

produced over 45,000 tons of high-priced salmon. And Canadian salmon farmers weren't far behind in their production of the pink-fleshed gourmet fish.

For Asian and Latin American aquaculturists, shrimp is the crop they're cashing in on. In Third-World country Ecuador, the shrimp culture industry has provided over 150,000 jobs and \$250 million in foreign exchange funds.

In the United States, aquaculture is in its infancy. Experts estimate that the business of fish farming contributes between 6 and 12 percent to total fishery production.

Presently most of that production (86 percent) is in freshwater species.

The Mississippi landscape glitters from the sun's reflection off acre after acre of catfish ponds. Twenty-five years ago, those ponds were as non-existent as the catfish industry.

But today, catfish farming is the nation's aquaculture success story. It accounts for over 50 percent of the U.S. cultured production.

But catfish may not be the aquaculture kingpin for long.

The production of other species is growing rapidly, and still more species are being readied.

Crawfish, for instance, used to be something only true Louisianians ate. But with the popularity of Cajun cooking, crawfish have become a hot culinary ingredient.

So hot in fact, that Louisiana aquaculturists are devoting 130,000 acres to the red-bodied crustaceans, and South Carolina plantation owners are converting abandoned rice paddies into crawfish ponds.

But whether it's catfish or crawfish, the aquaculture industry needed research to get its fish into ponds. In



These Scottish fish farmers harvest Atlantic salmon from floating net pens

the case of marine and coastal species, Sea Grant has provided much of the research support.

Sea Grant scientists spurred the production of blue mussels in Maine, redbfish in Texas, crawfish in Louisiana, salmon in the Northwest and prawns in Hawaii.

Texas A&M University Sea Grant researchers are perfecting the culture of the nation's most valuable crop—shrimp. Meanwhile, Washington and Maine Sea Grant scientists "neutered" cultured oysters to keep them plump and firm year-round.

And Sea Grant scientists in North Carolina, South Carolina and Maryland collaborated on a culture scheme for hybrid striped bass—aquaculture's rising star in the Tar Heel state.

So far, trout farming, limited to the mountain area, has been the most significant aquaculture industry in North Carolina.

North Carolina ranks a distant second to Idaho in trout production in the United States. Economists estimate that trout farming generates almost \$8 million for Tar Heel growers, a figure that is expected to double in the next few years.

Otherwise the state's aquaculture efforts have been limited to a few catfish farms, bait minnow operations and clam "gardens" on private bottom leases.

But with plenty of suitable land and water resources, the hybrid striped bass looms big in North Carolina's future. The white-fleshed, good eatin'



fish could be the answer to more than one farmer's prayer.

Sea Grant spent nine years refining the hybrid's culture. Now it's ready for commercial production (see story, page 4).

The hybrid and other cultured species got a boost this summer when the N.C. General Assembly appropriated \$400,000 for aquaculture development and extension at North Carolina State University.

North Carolina and other states realize the potential aquaculture offers for economic development. Already, big corporations such as Ralston Purina, Campbell Soup and Weyerhaeuser are gambling on the industry's bright future.

So the chances are high and increasing that the next steamed oysters, boiled crawfish or pan-fried trout you slide into your mouth will be pond-raised and home-grown.

a cash crop in the making: scientists develop hybrid

By Nancy Davis

The hybrid striped bass was about to receive its toughest test yet.

Sea Grant researchers had already proved the fish could be farm-raised. Now they wanted to see how their crop would fare in the marketplace.

So, in the spring of 1986, scientists Mel Huish and Howard Kerby harvested 4,208 pounds of hybrids they had raised from fingerling to pan-size in a year.

Raleigh seafood wholesaler George Earp bought the fish and packed them for shipping to Northern markets. Within two days, folks were feasting on fish that had been raised in research ponds outside of Raleigh.

Earp says he received \$1.99 a pound for the catch. And later, after the striped bass season was over, the fish sold for as much as \$3 per pound.

The hybrid had passed the test. And now, a year later, Earp is still giving the fish rave reviews.

"It's unreal. I think the hybrid striped bass will be just like the farm-raised catfish. Ten years ago if a man had told us that, we would have thought he was crazy. But it's a strong, strong business now. Down the road (the hybrid) is going to be a super big business," Earp says.

Earp isn't the only one extolling the virtues of the hybrid.

Ron Hodson, Sea Grant's associate director and coordinator of the program's aquaculture research, expects the hybrid to become a big cash crop for the state.

"I think hybrid striped bass can be to North Carolina what the channel catfish is to Mississippi," Hodson says. "With proper development, I can foresee this being a multimillion dollar industry to the farmers and

fishermen of North Carolina."

It's a pretty optimistic outlook for a fish that just a few years ago was still in the laboratory.

But behind all that optimism are nine years of intense research—most of it supported by the UNC Sea Grant Program.

It all started when natural populations of the savory striped bass dwindled.

Researchers tried to raise the striper, but it proved difficult to raise in captivity.

Then scientists figured out how to cross the striper with a white bass. The result was a hardy hybrid.

At first the hybrid was only stocked in recreational ponds and lakes. But it didn't take long for someone to come up with another idea.

Could the hybrid be farm-raised, like catfish, and fill the demand for wild striped bass?

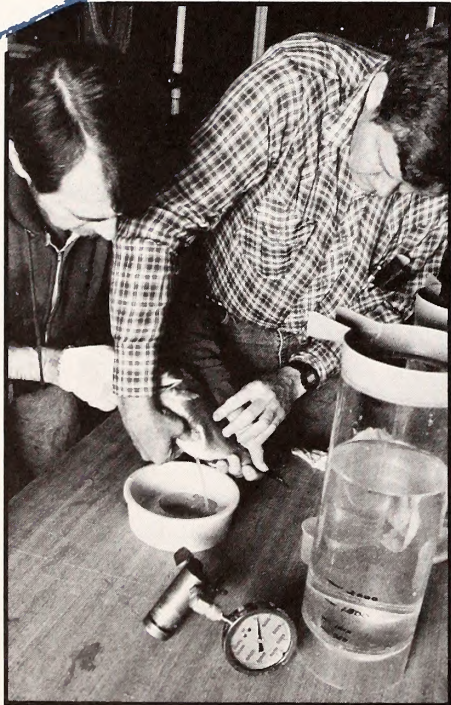
To find out, Sea Grant assembled a team of researchers. It included Ron Hodson, Howard Kerby, Mel Huish and Ed Noga from North Carolina State University and Margie Gallagher from East Carolina University.

Nearly 10 years later, the sale of Huish and Kerby's experimental crop proved hybrids can be farmed, and they can fill the demand for stripers.

What's more, the hybrid could be a savior for the ailing farm industry. Farmers with the right resources could use existing ponds on their land or build new ones.

Already, the results of the research are paying off. In Beaufort County, farmer Lee Brothers is the first aquaculturist to try to raise a commercial crop of the hybrid in ponds. (See story, page 6.)

Brothers' fish farm is the final



Ron Hodson and Howard Kerby strip eggs from female white bass

Photo by Scott Taylor

Sea Grant striped bass

phase of a coordinated research effort that began when Sea Grant scientists proved they could produce 1½-pound marketable fish within 18 months.

But that wasn't enough. Hodson knew that culturists like Brothers would have plenty more questions.

So he set out to refine methods for managing the crop.

Hodson created two scenarios. In the first, a farmer might want to grow hybrids on a small scale. He would use an existing pond and avoid the cost of additional equipment such as an aerator to keep oxygen levels high.

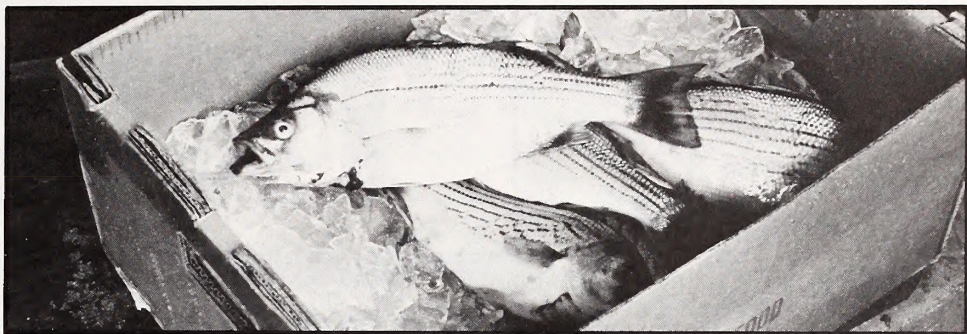
On such a small scale, Hodson found the farmer could stock about 1,000 fish per acre.

At the other extreme was a farmer willing to spend thousands of dollars on new ponds and equipment. He would stock about 10,000 fish per acre. At the end of the first year, he would harvest the fish, sort them according to size, and restock them at 4,000 to 4,500 fish per acre. If all went well, the farmer could expect to harvest as much as 5,000 pounds of fish per acre at the end of the second year of growth.

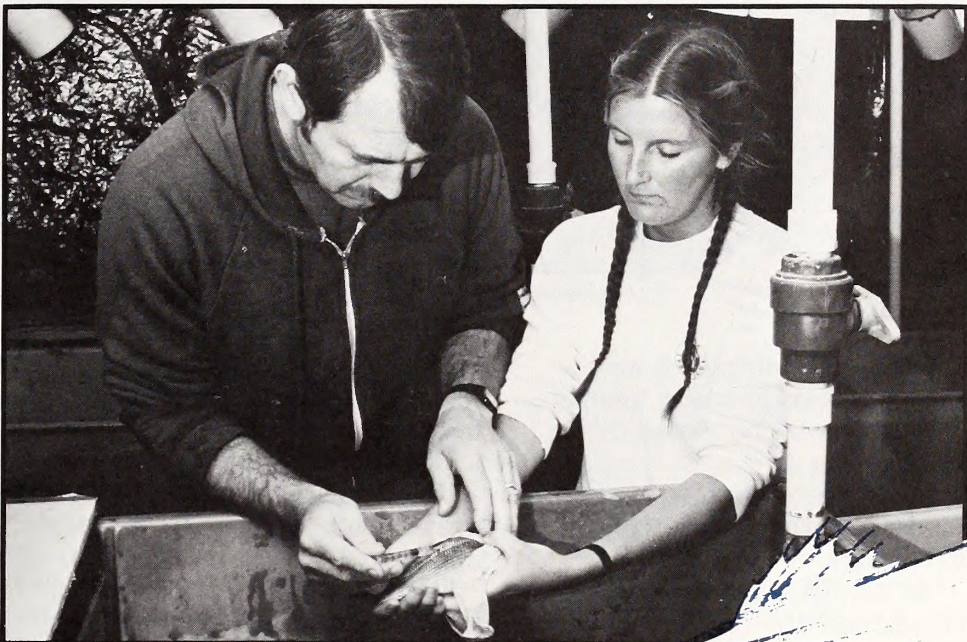
Once Sea Grant researchers proved that hybrids could be farmed, they concentrated on producing hardier, faster growing fish.

That meant going beyond just crossing striped bass with white bass. Kerby and Huish learned how to genetically manipulate the fish in an attempt to improve production and to develop a domesticated brood stock.

Sea Grant researchers are still at work on this problem. If they succeed in developing a brood stock, it will alleviate the need to collect scarce wild fish and will streamline the production of hybrids.



Just-harvested hybrid striped bass



Ron Hodson and lab assistant inject white bass with hormones

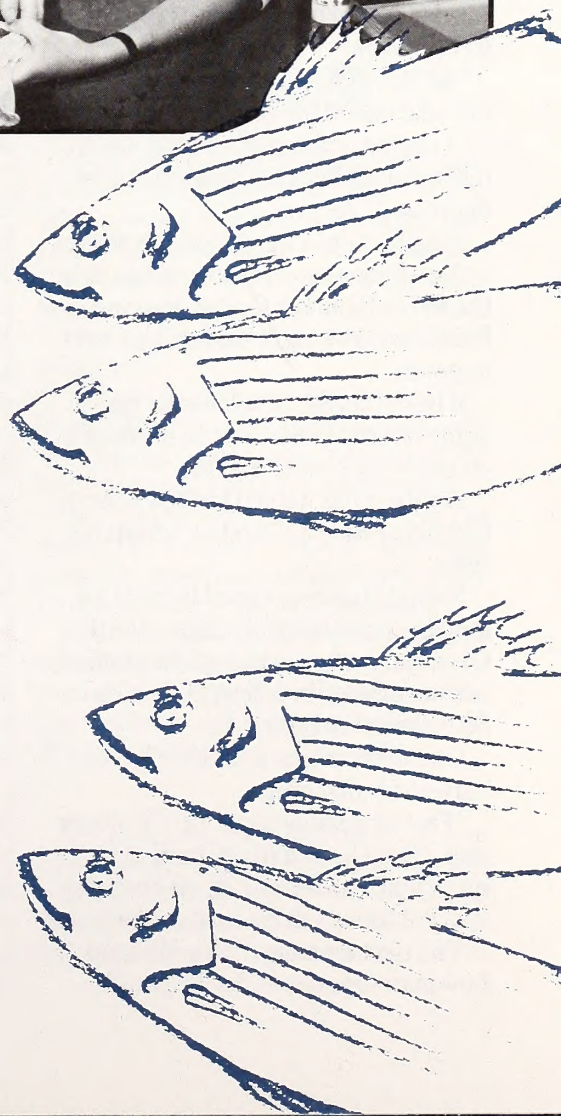
One of the biggest expenses in a culture operation is feed for the fish. The proper feed is not only cost effective for the culturist; it also results in faster-growing fish.

In her laboratory, Gallagher is determining what the hybrid's protein requirements are so she can recommend the proper protein/energy ratio for a feed.

And at the NCSU School of Veterinary Medicine, Ed Noga is working to assure that disease will not be a problem for fish held in such close quarters.

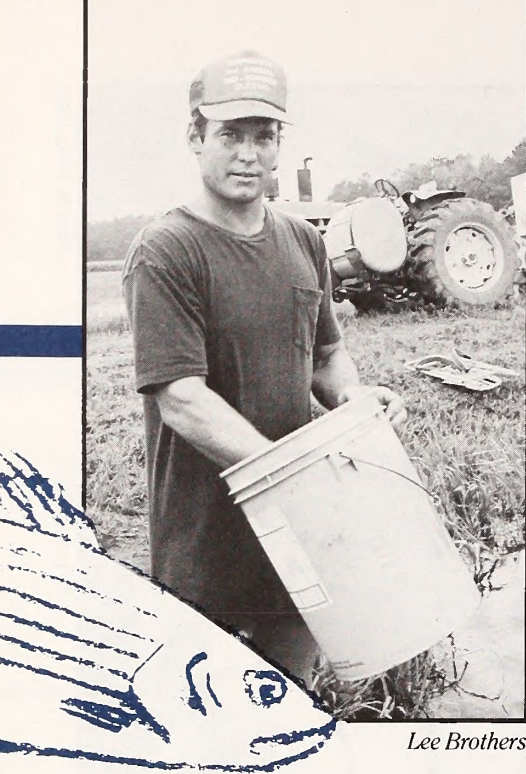
When Huish and Kerby sold their crop of hybrids, they proved the fish was marketable. But the real payoff for Sea Grant's hybrid research will come in the fall of 1988 when Brothers begins to harvest his first crop.

If he is successful, the state will have a new industry.



farmer raises a fishy crop

By Nancy Davis



Lee Brothers

When Lee Brothers took over his family's 800-acre farm near Aurora six years ago, the outlook for agriculture was dim.

Each day television news brought word of falling prices, failed crops and foreclosures.

But Brothers was determined not to become one of the statistics.

"I started looking at another way to make money because farming was so depressed," he says.

Now, he thinks he's found the answer.

Alongside rows of corn and beans in the fertile Beaufort County lowland, Brothers is raising hybrid striped bass in ponds.

If he succeeds, he will be the first aquaculturist in the state to produce a commercial crop of the fish.

Brothers has named his new venture Carolina Fisheries. And he admits it's risky.

Nobody has ever raised hybrids for food on a commercial scale in North Carolina. And even though he studied marine biology in college, this is his first attempt at raising fish.

One moment, he doubts he'll ever harvest his first crop.

"I'm not pessimistic at all," Brothers says. "But I keep it in the back of my mind that I could walk down here one day and those fish could all be belly up."

The next moment, he's adding up how many pounds of fish he could

harvest if everything goes well.

Eventually, the optimist in Brothers wins out. Like any farmer, he's not discouraged by the prospect of a failed crop.

"I'm not scared to take a chance," he adds. "I take one every year farming. If I can keep (the fish) alive until I sell, I'll be happy. It will be something that I can look back on my life and say I've done something."

Brothers' father Harvey is helping with the fish farm. He says it's his son's nature to experiment.

When Brothers was a youngster, he and his brother used a chemistry set to build a bomb. "They blew up the end of my tobacco barn," Harvey recalls.

Brothers reminds his father that his fish experiment should have more constructive results.

Ron Hodson, Sea Grant's associate director, believes that Brothers' operation could be just what the state's fledgling aquaculture industry needs. A successful harvest will encourage others to try fish farming. And the new industry could offer farmers an alternative to the fields.

If fish prove to be a moneymaker, Brothers says he'll forget all about corn and beans.

"I've always wanted to do something like this," he says. "This is right down my line. I love the water."

Last year after Brothers decided aquaculture was the way of the future, he spent several months traveling to other facilities and reading everything about fish farming that he could find.

His research indicated that declines of wild striped bass had left an unfilled demand for as much as 10 million pounds of the fish per year. The hybrid could help fill that void.

Realizing that Brothers' success could mean a new industry for the state,

Hodson obtained a grant from the National Coastal Resources Research and Development Institute (NCRI).

The grant will be applied to Brothers' project to help produce information that will help other growers assess the costs and potential profits of growing hybrids. And it will provide a chance to study the impact a large volume of fish will have on the demand and price structure of the market.

As part of the NCRI grant, Sea Grant will use Brothers' farm as a demonstration project for potential aquaculturists.

Brothers constructed his first ponds this spring. He dug three three-acre ponds, filled them with water and stocked them each with 30,000 hybrid fingerlings.

By late fall, he will seine the ponds, sort the fish according to size and restock them in three new six-acre ponds where they'll remain until harvest about a year later.

Until then, Brothers is taking notes about everything—whether it's the oxygen level in the ponds or how the fish are feeding that day.

The daily diary should help him next time around, and it could serve as a guide for new aquaculturists.

Even if his first year is not a financial success, Brothers intends to keep trying. It's not a farmer's way to give up after one bad year, he says.

He hopes that within two years, he will have sold his first crop, and some other folks will be encouraged to join him in the new industry.

Even Brothers' father, who has spent a lifetime farming, thinks aquaculture is going to be more profitable than agriculture.

He adds, "If I was a young man and I could get up enough money, I'd try it. But I'd wait and see how Lee did first."

THE BACK PAGE

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During peak seasons, fishermen often spend long hours on the water. And there's not always enough time for sleep.

But going without rest can affect a fisherman's performance. In some cases, a lack of sleep can lead to injuries.

When people are tired, they become careless, inattentive and less capable of making quick decisions, says Rick Steiner of the University of Alaska Marine Advisory Program. Lack of sleep can cause irritability, depression, disorientation and a loss of concentration.

Although most North Carolina fishermen don't stay away from the docks for days at a time, the odd hours can wreak havoc on sleeping patterns, says Bob Hines, a Sea Grant marine advisory agent.

Researchers say the only sure-fire cure is sleep. Naps, particularly between 2 a.m. and 6 a.m., can help.

When that's not possible, they prescribe the following measures:

- Rotate crew members so they don't perform the same task continually.
- Exercising and listening to high-spirited music can increase arousal.
- Brushing your teeth or taking a quick shower can help keep fishermen awake.
- Crew members should help each other out by keeping a conversation going.

Researchers who have studied sleeping patterns don't recommend the use of amphetamines or excessive amounts of caffeine.

"The buckets of coffee consumed by many a tired-eyed skipper can lead to some serious problems in the gastrointestinal and cardiovascular systems," says Steiner.



Three Sea Grant specialists recently won awards for outstanding achievements.

Joyce Taylor, Sea Grant's seafood education specialist, received the 1987 J. Keith Porter Award from the Mid-Atlantic Fisheries Development Foundation.

Taylor competed with seafood consumer specialists from New York to North Carolina for the award. She was chosen for her extensive seafood education program for consumers.

For years, Taylor has touted the virtue of seafood with seminars, publications and interviews with the media. In the past year, she traveled across the state conducting workshops on seafood selection and freshness, care and handling, and nutrition.

Marine agent Jim Bahen took on the job of teaching commercial fishermen about the unpopular turtle excluder devices. He also was instrumental in implementing marine weather reporting and sea surface temperature programs for fishermen.

For his service, Bahen was selected as one of North Carolina State University's Outstanding Extension Service Award recipients for 1986-1987.

On August 7, the National Marine Education Association presented its annual President's Award to Lundie Spence, Sea Grant's education specialist. Spence, who shares the award this year, received a plaque honoring her services to the organization and its membership at the annual conference in Kingston, R.I. Spence was president of NMEA in 1984.

There's been a lot of coming and going at the Sea Grant Aquaculture Lab in Aurora.

In May, advisory agent Randy Rouse

resigned to pursue an endeavor in private industry. And in June, lab technician BeLinda Hoots moved to the Midwest.

Now the lab is under the care of Dave Bova and Luke Wood.

Bova has a degree in marine biology from the University of Miami. He has several years of experience with a Delaware firm that produced striped bass for a restocking program.

Wood is a 1987 graduate of North Carolina State University's Department of Biological and Agricultural Engineering.



They say necessity is the mother of invention. Sea Grant agent Bob Hines and a Marshallburg crab shedder agree.

Early this spring, the crabber built a system for shedding soft-shell crabs. But the water in his shedding trays remained too cool for the crabs to molt.

So Hines and the fisherman devised a solar water heater for the system. With a 4-by-8 foot box, some glass and plenty of piping, they built a collector. They wanted it to heat the water to 70 degrees and induce the crabs to shed.

The collector worked, but it had some problems.

"The materials we used were not ideal," Hines says. In addition, problems with leakage and the small surface of the collector complicated the operation.

But Hines isn't giving up yet. On sunny, but cool days in early spring the collector raised and stabilized the water temperature in the trays, he says.

When outside temperatures ranged from 45 to 55 degrees, temperatures in the tanks reached 55 to 60 degrees. "We were able to get it up to and over 70 degrees some days," Hines adds.

Artificial seaweed has taken hold as a prospective method of erosion control.

In theory, the long strips or tufts of fiber act as underwater sand fences that build sandbars. But tests in North

Continued on next page

Carolina, other states and Europe consistently have shown that artificial seaweed is ineffective in controlling wave-induced shoreline erosion.

Spencer Rogers, Sea Grant's coastal engineer, examines this alternative in a new publication, *Artificial Seaweed for Shoreline Erosion Control?*

In it, he addresses the development, experiments, problems and improvements of artificial seaweed in the past 25 years.

For a copy, send your name, address and \$1 to Sea Grant. Ask for UNC-SG-WP-86-4.

The Florida Sea Grant College Program has produced a two-part videotape about yellowfin tuna. Part I describes fishing methods and gear for yellowfin tuna. It illustrates the construction, deployment and retrieval of mid-water

longline gear used to harvest yellowfin tuna.

Part II describes on-board handling and grading for yellowfin tuna, including killing, cleaning, chilling and icing the catch.

To buy the set of tapes, send \$15 to Sea Grant Advisory Program, G022 McCarty Hall, University of Florida, Gainesville, Fla. 32611.

There was something fishy about the pasta served at a fleet-blessing celebration in Georgia this summer.

Instead of the traditional pasta found in macaroni salad, visitors were surprised to learn that they were eating surimi.

Yao-wen Huang, a Georgia Sea Grant researcher, concocted the macaroni out of menhaden surimi produced by Zapata

Haynie's Reedville, Va., pilot plant.

Huang's dish got good reviews. Reita Rivers of Georgia Sea Grant has participated in several taste tests of the new product. She says it has no fishy flavor and a texture very similar to the real thing.

Huang plans to test market the fish pasta in ethnic areas in Atlanta.

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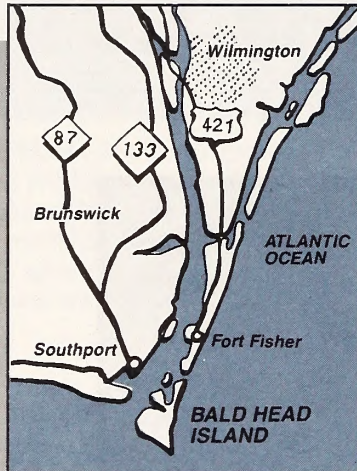
Photo by Nancy Davis

BALD HEAD ISLAND



Balancing development with conservation

BY NANCY DAVIS



Old Baldy stands watch over the island



The battleground was a small piece of paradise, 13,000 acres of sand, marsh and maritime forest lying at the mouth of the Cape Fear River.

It was North Carolina's first war of the coastal environment, and it raged for nearly two decades. Environmentalists fought for preservation. Developers sought a posh resort with a population as high as 180,000 and even an international airport.

The prize was Bald Head Island, which, along with Middle and Bluff islands, makes up the Smith Island complex off the Brunswick County coast.

In the end, neither side won.

Those who wanted the island to become a state park still shake their heads over a paradise lost. But there is a consolation, they say.

If the island had to be developed, its latest owner has created an acceptable blend of preservation and change.

The developer agrees.

"Bald Head Island should have been preserved," says Kent Mitchell. "But if it had to be developed, then I'm the best one to do it—without question."

On Bald Head, nature has united an odd combination of temperate and tropical life. Large stands of palm trees grow farther north than they're supposed to, and temperatures average several degrees warmer than on the mainland just three miles away.

At one time, Bald Head claimed the state's largest maritime forest. It is still the most popular nesting ground in the state for the endangered loggerhead sea turtle.

"If Bald Head had been preserved, it would be even more unique now," says Art Cooper, head of North Carolina State University's forestry department and one of the leading proponents of preservation.

But like the rest of the Tar Heel coast, pressures to build won out over the push to preserve.

Mitchell is the latest in a succession of owners, and his plans for the island are less ambitious than previous designs.

"My main overriding philosophy is, 'What is a place that I'd like to bring my kids back to in 20 years?'" Mitchell says. "There is a natural beauty that God gave this island," he says. "It is a wild, volatile environment, and I have a chance to preserve it."

In the 1960s, Smith Island complex owner Frank Sherrill proposed the most elaborate plans for a Bald Head Island resort.

But frustrated by state opposition to his plans, he offered the complex of islands to the state for about \$5 million, a price the state considered too high.

So in 1970, Sherrill sold to

Carolina Cape Fear Corporation. That was the start of a 10-year battle with government agencies and environmental groups.

As a peace offering, Carolina Cape Fear gave Bluff Island and about six miles of oceanfront beach to the state. But by then, the company was drained. Mortgagors foreclosed, and Tar Heel native and Texas millionaire Walter Davis bought the island.

Davis continued the development, building a marina and Bald Head villas.

In 1983, Kent Mitchell and his brother visited the island. They convinced their father, another wealthy Texan, to buy the island. At the time, the senior Mitchell was described as one of the ten wealthiest men in the country.

Kent Mitchell, a Harvard architecture graduate, found himself caught almost immediately between his belief that the island should have been preserved and his desire to turn it into a model resort.

"We fell in love with the island before we bought it. We still love the island, and that's the tough battle," Mitchell says. "It's a tough compromise between making money and maintaining the balance with the environment."

The result has been Mitchell's own version of a beach community.

Bald Head lacks the characteristic bright lights, neon signs and high-rise condominiums of a typical resort.

Aside from the glow of two streetlights, the only night light on the island comes from the moon and stars. Neon is taboo, and height is scorned.

Visitors drive electric golf carts because gasoline-powered vehicles are forbidden. And the roads are narrow asphalt paths that wind through the lush canopy of live oaks.

Before Carolina Power & Light Company brought electricity to the island in 1981, homeowners relied on individual generators for their power, prompting early residents to form a Generator Society.

Until recently, the only contact

with the mainland was by CB radio. Phone service should be available by 1988, but some residents plan to do without the convenience. The idea, they say, is to get away from it all.

And that's not hard to do on an island whose only connection to the mainland is by private boat or a ferry from Southport run by the developer.

This is Mitchell's first big project, but such developments are nothing new for his family. In addition to building a planned city of 200,000 people outside of Houston, the Mitchells have been active in a push to restore a historic area of Galveston.

When Mitchell took over operations at Bald Head, much of the first stage of development was complete. He inherited an inn, a restaurant, an 18-hole golf course and 40 to 60 townhouses and villas. Some private homes had also been built.

With that stage nearly complete, Mitchell is ready to begin a second stage that will include 600 acres of the eastern portion of the island.

By the time the Bald Head project is complete in 15 years, about 1,600 acres of the 3,000-acre private tract will have been developed.

Although about a third of the first stage was condominiums, about 90 percent of the second stage will be single-family homes. And no high rises, Mitchell says.

"I have a personal aversion to high-rise garbage," he says.

"North Carolina and South Carolina have a tradition of nice beach communities. But in the last 10 to 20 years, you have seen the worst form of Florida, cheap high-rise development. I'm not sure if we can succeed, but I hope we can impart some of the character of a traditional beach community here," Mitchell says.

Strict guidelines mandate not only the size of a house, but also its appearance. Most homes are stained with a natural wood color, and all plans must be drawn by an architect.



Building on Bald Head is strictly regulated

Photo by Nancy Davis

Bulldozing lots is forbidden. Many homes are tucked between the trees, and residents are encouraged to landscape with native plants. Manicured grass lawns are frowned upon.

It isn't easy for the average North Carolinian to appreciate Bald Head.

The residents are one indication of the costs of living there, Mitchell says. He estimates that 25 percent are doctors and 25 percent are lawyers.

Land isn't cheap. Lots average half an acre, but range from quarter-acre parcels to two-acre lots, Mitchell says. And the costs start at \$30,000 and go up to \$200,000 for a beachfront lot.

And once you buy a lot, you have to consider the cost of building. It is considerably higher than elsewhere on the Tar Heel coast because residents must absorb the cost of transporting materials from the mainland by barge.

Except for the occasional inconvenience of living on a remote island (see story, page 6), property owners are happy with their piece of paradise.

"For those who have found Bald Head, they can't go anywhere else. Nowhere compares to it. It's for a special breed of person," Mitchell says. ■

Preserving a unique environment

BY SARAH FRIDAY

Carol Mayes turned just in time to see an alligator facing her on the other side of the creek. She'd been collecting plants when a sudden splash diverted her attention.

Photo by Scott Taylor



Salt marsh makes up 9,000 acres of the Smith Island complex

Luckily, the reptile had another meal on its mind. The legs of a raccoon were wriggling in its mouth.

Such incidents on Bald Head were rare for Mayes, director of stewardship for the N.C. Nature Conservancy. But the balancing acts of nature continue there everyday.

Now people who want to preserve the wildlife and natural surroundings of Bald Head have become part of another kind of balancing act. Naturalists, developers, homeowners and tourists are weighing the need for change against the need for conservation.

To them, Bald Head's environment is like no other—so different that some people believe it's a mistake.

"South Carolina should have started just north of Bald Head," says Lundie Spence, Sea Grant's marine education specialist. "Bald Head represents a subtropical environment in a temperate state. The obvious evidence for this is palm trees."

Temperatures range from 25 F to 92 F, mirroring the climate of Myrtle Beach. And there's a reason. Bald Head is the northernmost of a chain of islands, the Sea Islands, that lie off the coasts of northern Florida, Georgia and South Carolina.

And since water surrounds Bald Head, the ocean moderates the weather so it's cooler in the summer and warmer in the winter. The nearby Gulf Stream also warms the air.

Bald Head's balmy climate—and a clever entrepreneur—lured tourists to the rustic resort in the 1930s. Before that, the island was a hideout for pirates and a lookout for Civil War troops. And it made fertile ground for pig farms and logging camps.

Years later, the setting is much the same.

A maritime forest, shrub thickets, salt marshes, tidal creeks, ponds and dunes make up the highest quality maritime system remaining in North Carolina, Mayes says.

The combination is a treasure to naturalists such as Mayes. And the crown jewel is the maritime forest.

The thick woodland has survived centuries of salt spray, hurricanes and other harsh oceanic conditions. Today it covers 1,126 acres of the Smith Island complex. The major part of the forest lies behind the dune ridge on Bald Head, but portions also grow on Middle and Bluff islands.

As one of the largest and oldest maritime forests in the state, the woodland stands as evidence of the island's stability. One live oak measuring 17 feet 6 inches around is estimated to be more than 300 years old.

The forest also supports trees and plants from two different regions. Southern species such as the sabal palm grow alongside Northern species such as the live oak.

The thick canopy they create protects the interior of the forest from salt spray and allows other plants to thrive. Loblolly pine, dogwood, wax myrtle and yaupon provide additional cover for the island's abundant wildlife.

It's not unusual to see a gray fox darting in front of your golf cart at night. Or a raccoon munching on berries.

And someone recently reported seeing a bobcat, but island naturalist Bill Brooks is waiting for proof.

Outside the forest, Brooks spends most of his time tracking turtles.

In 1981, naturalists from the Wildlife Resources Commission and the N.C. Heritage Program discovered that Bald Head hosted the state's largest population of nesting loggerhead turtles. They soon realized, however, that 90 percent of the eggs were eaten by foxes and raccoons.

To remedy the problem, naturalists Debbie Crouse and Joe Newman founded the sea turtle conservation project. They devised a wire screen to protect the nests and began monitoring them closely.

Interns from the N.C. Nature Conservancy helped out in the summer, but by 1983 the project had become too big for the inland agency to supervise.

In November, the Bald Head Island property owners' association passed a charter creating the island's own non-profit conservancy. And they employed a naturalist to keep watch over the loggerheads.

Today 95 percent of the turtle eggs hatch.

Like the beach and the forest, each ecosystem on Bald Head supports a unique collection of plants and animals. Together they seem to form an open-air natural history museum.

Maintaining the museum takes effort.

The developers must build. Buyers and renters want peace and tranquility. Naturalists need to preserve the integrity of the island.

Harmony is sometimes elusive.

During the first stage of building in the 1970s, developers cut down large portions of the maritime forest, weakening the canopy, says Cindy Meekins, board member of the Bald Head Conservancy Inc. and former island naturalist.

Their mistake was evident, Meekins says, when Hurricane Diana swept through Bald Head in 1984 and damaged 70 percent of the forest and most of the golf course fairways.

"It took them months to fix that," Meekins adds.

The current developers, Bald Head Island Limited, took a different approach. After working with conservationists, the group devised a blueprint for construction that left much of the environment intact and did not include another golf course.

They also compiled a 62-page book outlining specific landscaping recommendations and standards for prospective Bald Head residents.

And they contributed 100 percent matching funds to the Bald Head Island Conservancy in its first two years. They still match half of the group's contributions.

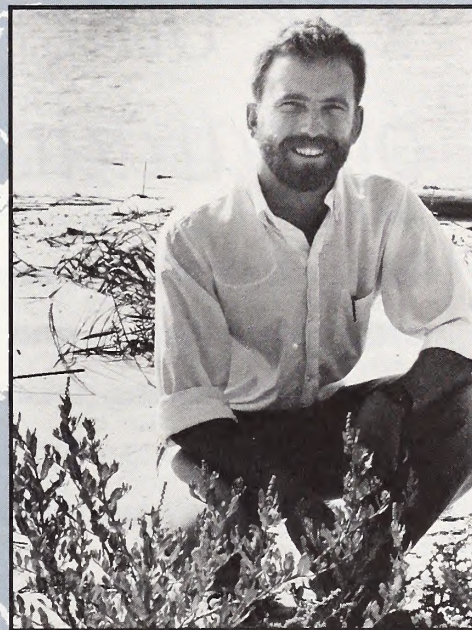
"They want to make sure our efforts succeed," Meekins says. "They realize that if we work together we'll get a lot more done."

So far, so good, according to Brooks.

"Overall, people are happy with how it's been developed," he says. And the effects of building haven't been all bad in regard to plants and animals.

For small animals, development increases habitat, because it creates more diversity around the forest edges, he adds. But for animals that use the deep forest, development decreases living room.

Photo by Sarah Friday



*Bald Head Island
naturalist Bill Brooks*

Saving habitat is one of the conservancy's priorities. The sea turtle project is another. But the group also offers educational programs, landscaping advice, a day camp and nature hikes.

And Brooks hopes that in the next two years the conservancy can expand its role as landscape consultant, helping residents pinpoint important vegetation on their property and relocating any rare or endangered plants.

Homeowners are receptive to the idea, as many share an appreciation for nature. About 250 of the 900 property owners are members of the Bald Head Conservancy.

Like the three branches of government, the conservancy, the property owners' association and the development organization operate their own informal system of checks and balances. Each appoints members to sit on the boards of the other groups.

The state keeps a watchful eye on Bald Head's unique environment, too. The Museum of Natural Sciences, Zoological Park, Wildlife Resources Commission, Nature Conservancy and divisions of Marine Fisheries and Parks and Recreation monitor many of the natural areas. ■



Photo by Nancy Davis

The other side of paradise

BY NANCY DAVIS

Life on Bald Head Island is everything it's cracked up to be...and more. Along with the stunning sunsets, pounding surf and soothing silence come monstrous mosquitoes, hungry alligators and, read carefully, NO BRIDGE.

We're not trying to be negative, mind you. We just want to point out that island life isn't for everybody.

Residents who pay a healthy price for the beauty and serenity of the remote island also get an expensive dose of inconveniences.

And the emphasis is on remote.

There is no bridge from the mainland to Bald Head. Residents say that after a week, they quit worrying about it.

For newcomers, that three-mile span of water makes the island seem as though it's 300 miles from the mainland.

But what if I have to get off of here?

If you have your own boat, it's simple.

If not, you'll have to wait for the ferry. It leaves every hour on the half-hour from the island and on the hour from the mainland. And it's just a 15-minute ride.

But what happens late at night when the ferry stops running and

I'm sick and I need to get to the hospital?

The village employs four public safety officers who serve as emergency medical technicians, firemen and police.

If you need to get to a hospital, just pick up your CB and call them. They can have you to the Southport hospital within 28 minutes, says Wallace Martin, village manager.

What's this about CBs? When can I phone home?

Well, phones will be available by the first of the year, but some residents still plan to do without.

There are about five phones on the island now. But they're operated by a microwave system set up in the Bald Head lighthouse. On foggy days or when a tall ship passes, calls are likely to be cut off.

So you'll just have to learn to pick up your CB, good buddy.

Where can I eat on the island?

Your choices are limited. There's one restaurant and one deli.

What about groceries?

There is a small store on the island. And it's even stocked with items such as fresh gourmet coffee beans, a good selection of wines and an assortment of caviar.

But for a week's worth of groceries, you may want to go to the mainland.

Plan your trip carefully. It will require close scrutiny of your remaining rations, a detailed list of next week's meals and plenty of travel time.

Suppose you take the 10:30 a.m. ferry from the island. Depending on where you live, allow yourself extra time to get to the ferry. Remember, only 18 mph in your electric golf cart.

By the time you get to Southport and do your shopping, it will be after noon. You drive back to the dock just in time to reserve your place on the 1 p.m. ferry. Another 15 minutes, and you're back on the island.

What about my ice cream and milk?

If you were smart, you remembered to bring along the cooler. Better yet, just buy your ice cream from the island's store.

I'm not discouraged by those little inconveniences. I'm ready to build my dream vacation home. But where do I get my supplies?

The mainland, of course. All the construction materials have to be shipped to the island by barge.

Everything has to be carefully scheduled so that crews and materials arrive on the island at the same time, Martin says.

"You get the workers over here and find out they need three 2-by-4s," Martin says. "So they're sitting there twiddling their thumbs until the next barge comes."

One contractor estimates that shipping building supplies by barge adds as much as 25 percent to construction bills. ■

THE BACK PAGE

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Christmas is just weeks away. If you haven't finished your shopping, how about a browse through the Sea Grant shelves. We've got a book for just about everyone.

Here's a sampling from our catalog. To ensure delivery by Christmas, send in your order and payment promptly and indicate the publication number.

Seashells Common to North Carolina is one of our most popular publications and sure to please any beachgoer. The 36-page booklet provides detailed descriptions and photographs of shells you're likely to find on Tar Heel beaches. Ask for UNC-SG-72-09. The cost is 75 cents.

If there's a coastal property owner on your list, he'll be sure to enjoy *Seacoast Plants of the Carolinas*. It's a valuable tool for landscaping or just for identifying various plants. Ask for UNC-SG-73-06. The cost is \$2.

And how about a copy of *Coastal Capers: A Marine Education Primer*? This 76-page booklet is full of activities for parents and young children. The "capers" are fun and educational. Ask for UNC-SG-84-05. The cost is \$3.50.

For sportsmen, Sea Grant has a variety of publications. One of the most popular is a cookbook. *Recipes with a New Catch* contains instructions for handling and preparing 16 species of non-traditional fish. You'll find recipes for shark, triggerfish, bluefish, amberjack and more. Ask for UNC-SG-86-06. The cost is \$2.

A Guide to Recreational Shrimping provides tips for rigging small boats for catching the tasty crustaceans. Ask for UNC-SG-86-07. The cost is \$4.

When a single clam brings 10 cents to 20 cents at the seafood dealer, coastal folks start talking about raising or culturing the valuable mollusks. People want to know how to handle the young "seed" clams and how to rear their older counterparts in beds, or gardens.

That's why Skip Kemp, a Sea Grant specialist, has set up a clam nursery demonstration site behind the N.C. Aquarium at Pine Knoll Shores. In a cooperative project with the aquarium, Kemp has built a mini-nursery to show prospective clam gardeners different clam rearing techniques.

If you'd like to visit the demonstration site, call Kemp at 919/247-4007.

Kemp also has up-to-date supplier lists for shellfish seed and plastic mesh. The mesh is used to protect the clams from predation once they're put to bed.

And, prospective gardeners may want to mark their calendars for Feb. 6. Sea Grant is cosponsoring an all-day clam grow-out conference at the Duke University Marine Laboratory in Beaufort. Further details about the conference will be announced in the January *Coastwatch*.

Sea Grant is sponsoring a national technical conference on surimi, a minced fish product used in restructured seafoods.

Until recently, most surimi was made from Alaska pollock. But Sea Grant researcher Tyre Lanier has proved that fatty fish, such as menhaden, are also acceptable in making surimi.

The conference, to be held in Raleigh Dec. 10 and 11, will examine the use of fatty fish in surimi. It will attract industry leaders and international experts in surimi research.

Write Sea Grant for more information on the conference.

Sea Grant and the Carteret County Waterman's Association are hosting the eighth annual N.C. Commercial Fishing Show March 12 and 13.

Last year more than 5,000 people attended the boat and gear show in Morehead City. And even more are expected this year for the show that will feature boats, engines, electronics, fishing gear and accessory equipment. Workshops

and seminars on fisheries topics also will be offered.

Dealers and manufacturers interested in securing a booth at the show may call Sea Grant agent Bob Hines at 919/247-4007.



Fall is a time for moving south. Wild swans, geese and ducks fly to North Carolina sounds to avoid the bitter northern winter.

But birds aren't the only southbound creatures.

In October and November, migrating fish such as bluefish cruise through North Carolina's coastal waters on a trek to warmer waters.

Schools of bluefish often concentrate at Cape Hatteras. And when bait fish are close to the beaches and conditions are just right, a bluefish blitz is likely.

Lundie Spence, Sea Grant's education specialist, describes a blitz.

"Small bait fish are driven to the water's surface with bluefish slicing through them. Sometimes the small fish are driven onto the beach. Gulls and terns cash in on the blitz as they dive for loose scraps," Spence says.

Word of a blitz travels quickly. Soon a crowd appears, and everyone is casting and reeling in blues.

But Spence urges fishermen not to get so caught up in the action that fish are wasted.

Gut and ice your catch immediately, and freeze what you can't eat in a short time. Because bluefish are oily, their freezer shelf life is only about three months.

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To our readers,

Federal budget cuts are making for tough times in the Sea Grant communications office. Since 1980, our budget has remained the same while inflation has gotten the best of us.

The cost of producing publications—printing, design, mailing—continued to increase and buying power decreased.

But we scrimped and saved and continued to send more than 18,000 of you a free *Coastwatch* at a cost of about \$4,500 each month.

With no extra funding to meet these increases, Sea Grant is faced with some tough decisions. We are considering cutting *Coastwatch* from 10 issues a year to five and eliminating the newsletters produced by the Marine Advisory Service agents and specialists. That includes *Conchshell*, *MAS News* and *Legal Tides*.

Many of you have told us how much you appreciate *Coastwatch* and look forward to its arrival each month. We'd like to continue to provide you with this informative newsletter 10 times a year, but we can't without some extra dollars.

If you'd like to help the program with its publishing plight, we'll thankfully accept contributions. Send your tax-deductible donation to Sea Grant Communications, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Please make checks payable to North Carolina State University.

Thank you,

Kathy Hart
The Editor

COASTWATCH

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